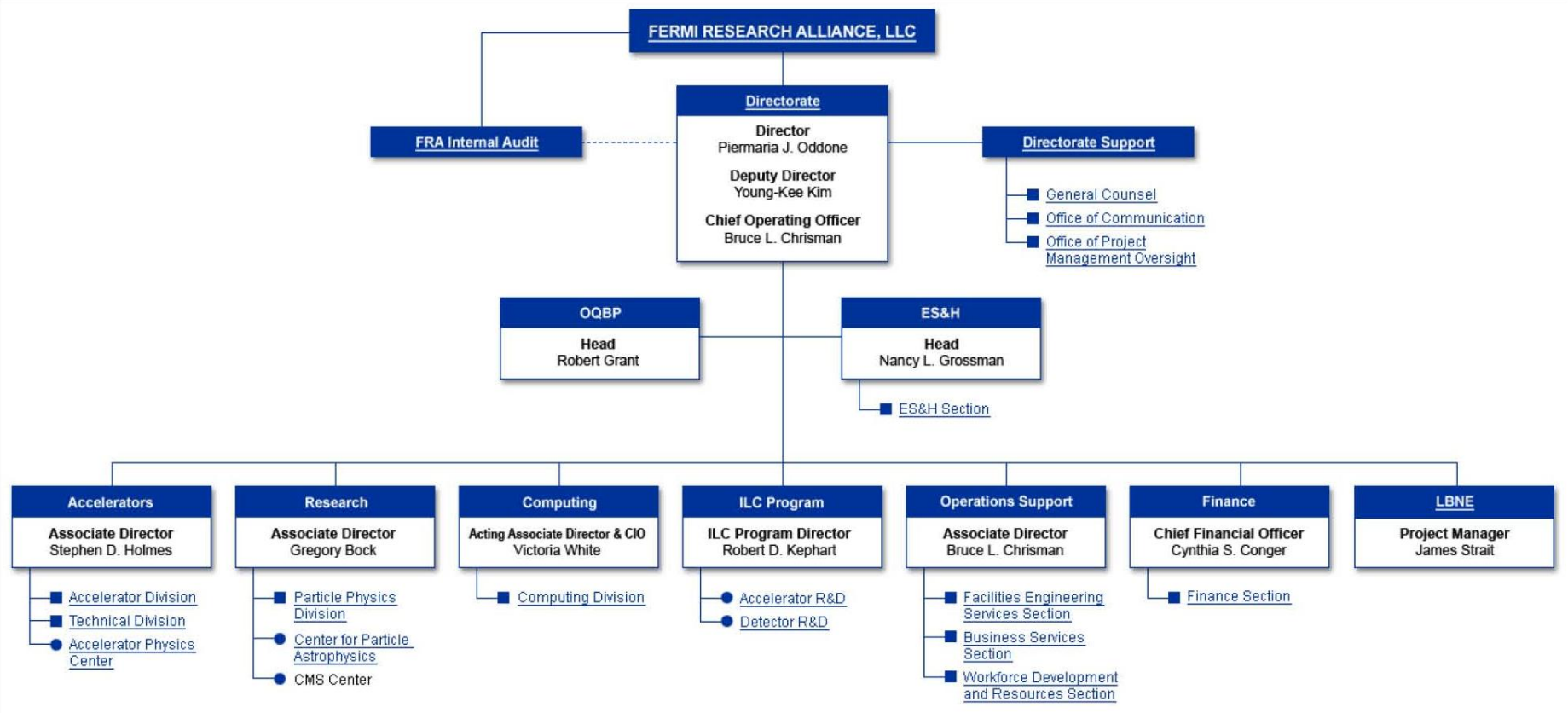


Laboratory News and Programs

*Young-Kee Kim
Deputy Director*

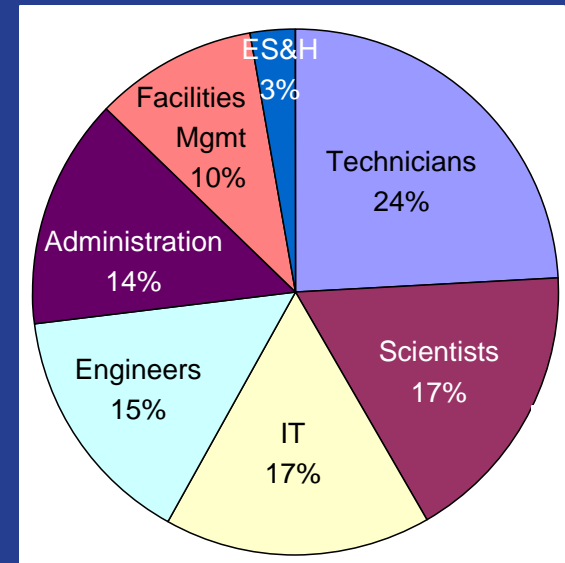
*Meeting of the FRA Visiting Committee for
Operations / Administrative Peer Review
August 2-4, 2010*

Fermilab Organization



Fermilab characteristics (FY2010)

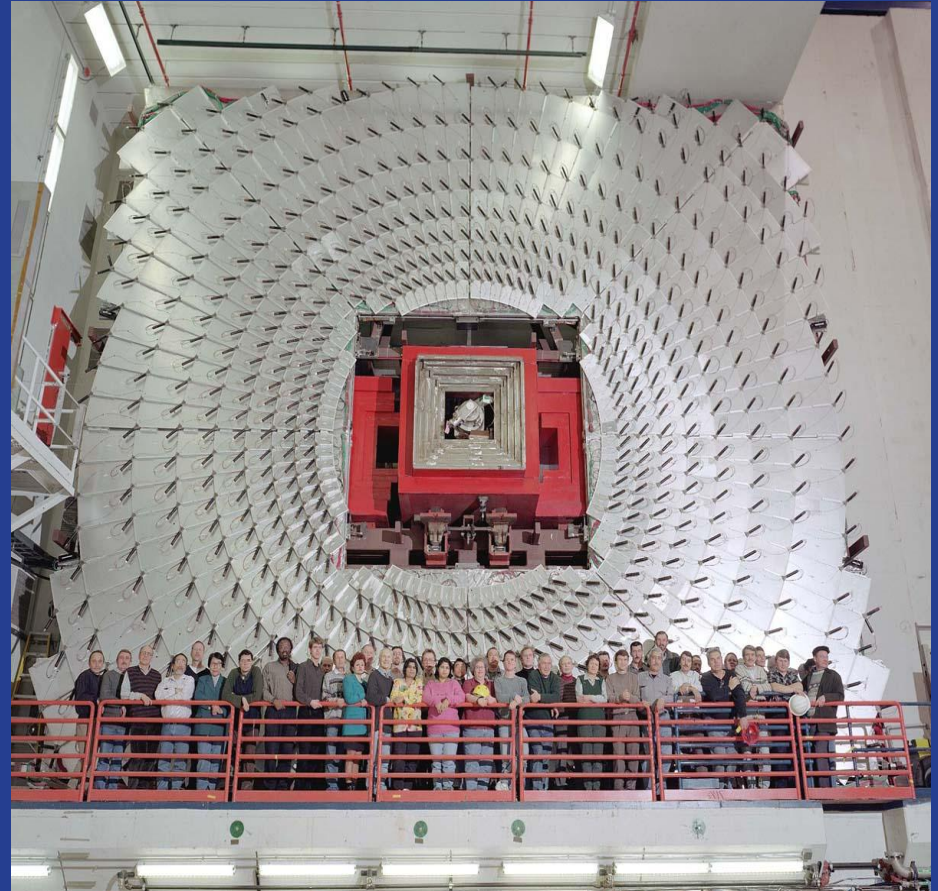
- 1943 employees; \$ 410 M
- 2300 users and visiting scientists
- 6800 acres, park-like site



- Tevatron: most productive collider probably through 2011
- Highest intensity neutrino beams (low & high energy)
- A world class astrophysics, particle theory and computation programs
- Advanced detector and accelerator technology

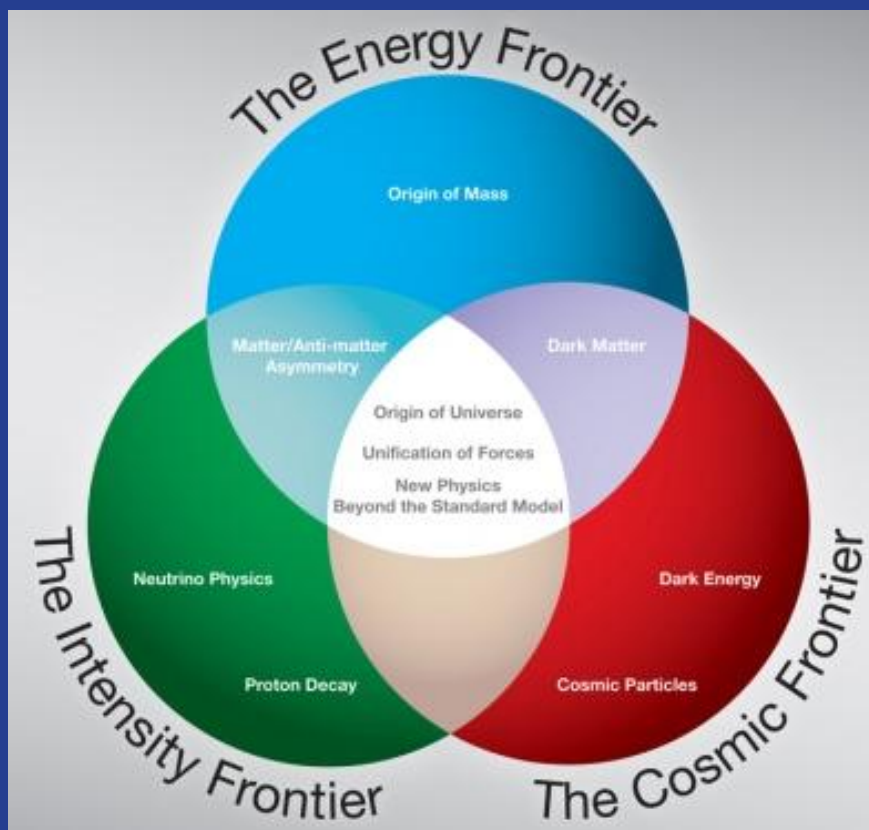
Mission: the national particle physics lab

- Enable the US community to tackle the most fundamental physics questions of our era
- Interdependence: integrate the universities and other laboratories fully into national and international programs

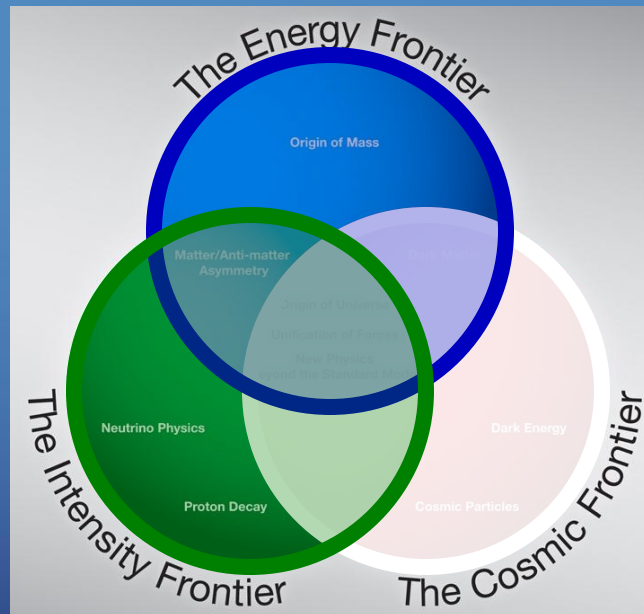


Program drivers: science

- The sense of mystery has never been more acute and evident in our field



Accelerator-based programs at Fermilab Now and Future



Cockcroft-Walton



Linac



Booster



Main Injector



Tevatron



Antiproton

Production &
Accumulation

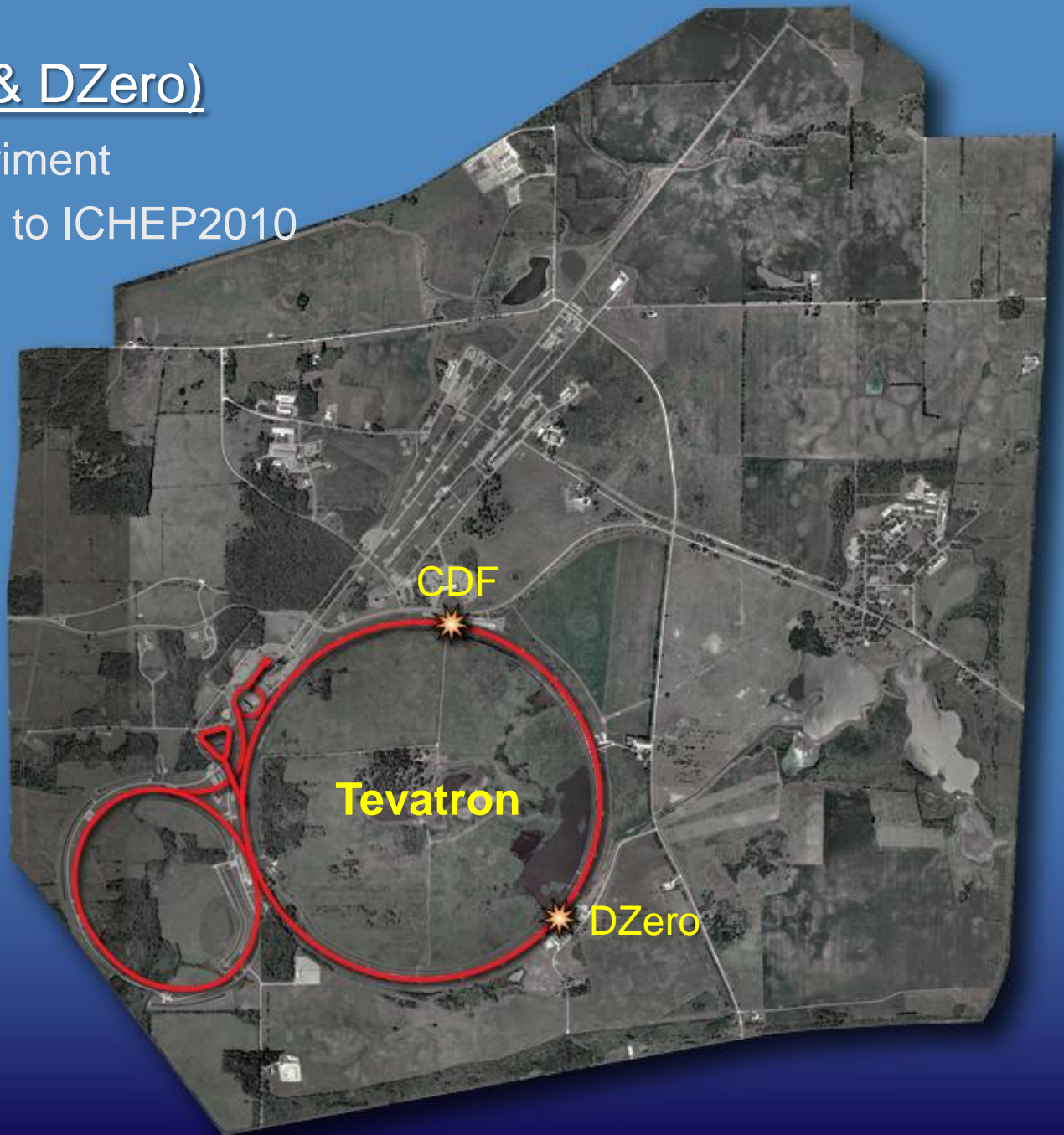
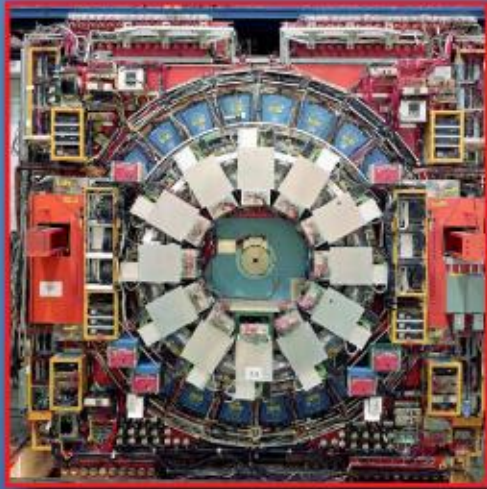
Storage Ring
(Recycler)



Tevatron (CDF & DZero)

$> 9 \text{ fb}^{-1}$ / experiment

152 abstracts submitted to ICHEP2010



ν 's from Main Injector

MINOS (on-axis)

MINERvA since Mar. 2010

ArgoNeuT (0.3 ton LAr TPC)

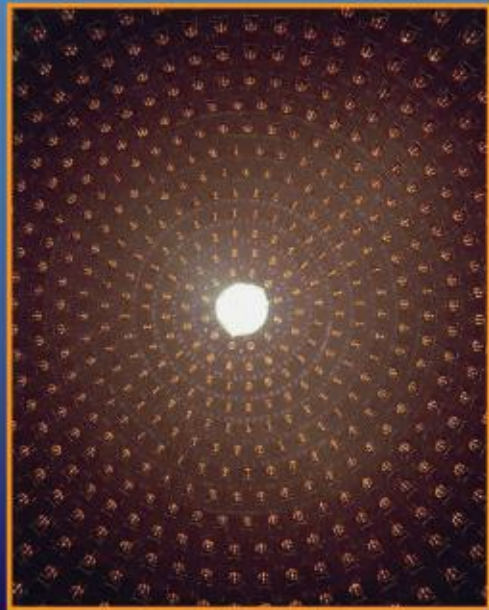
NOvA (near detector)



ν 's from Booster

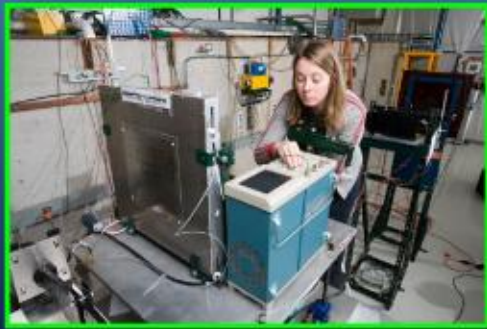
MiniBooNE

SciBooNE (Jun.2007 – Aug.2008)



Testbeam

for Detector Development
supporting the
international community



Test Facility for Accelerator Development

Super Conducting RF
Technology



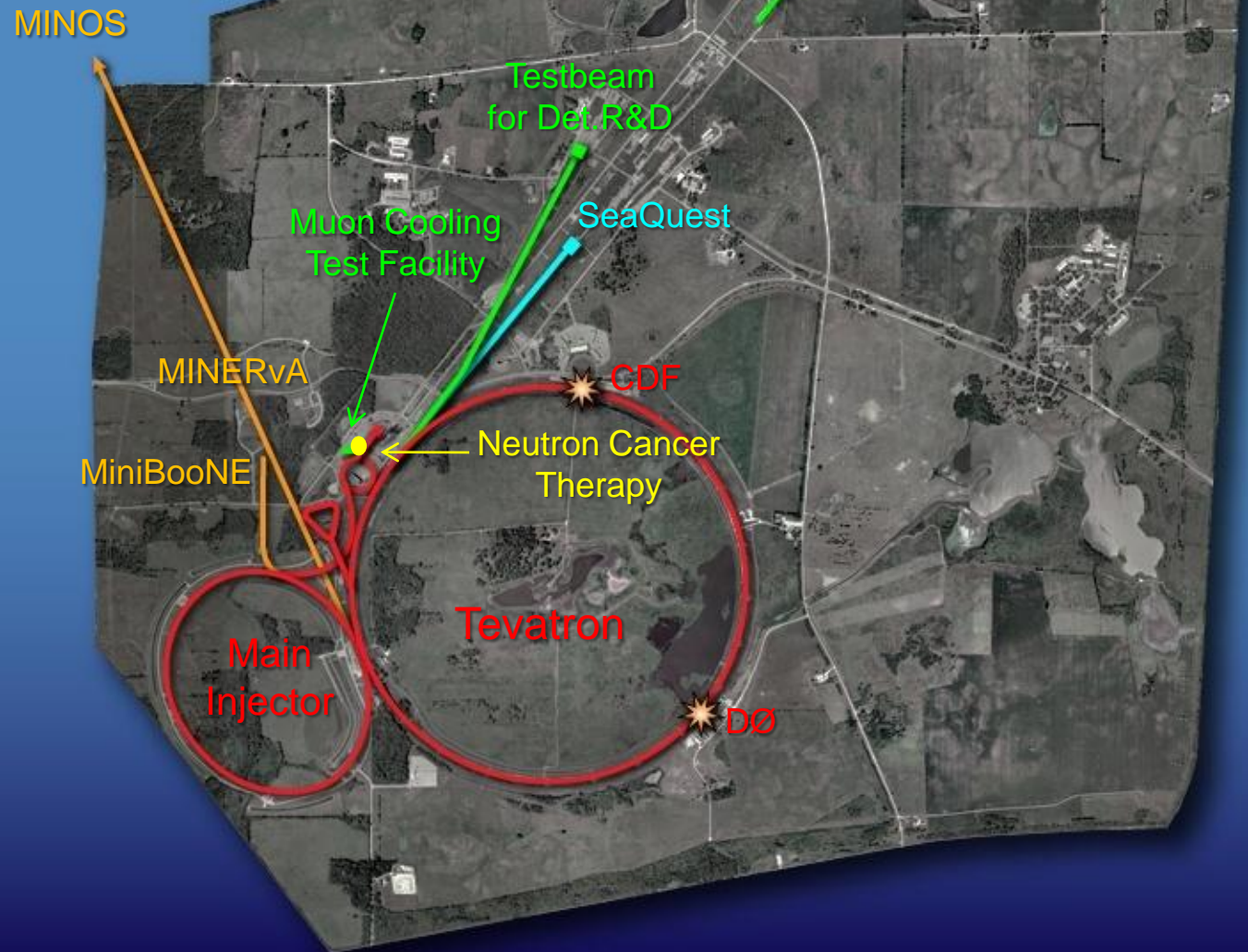
Test Facility for Muon Cooling (MuCOOL)



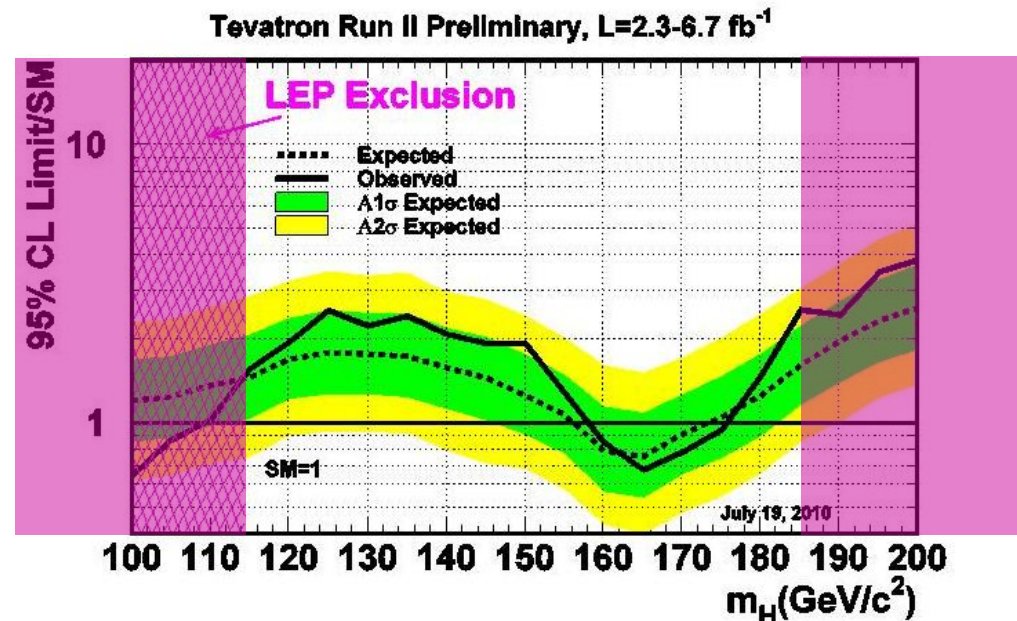
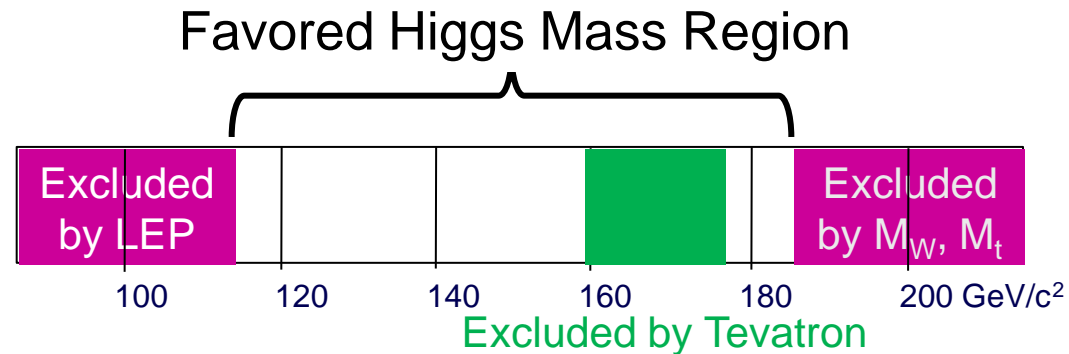
SeaQuest



Fermilab Accelerator Complex Operating Simultaneously

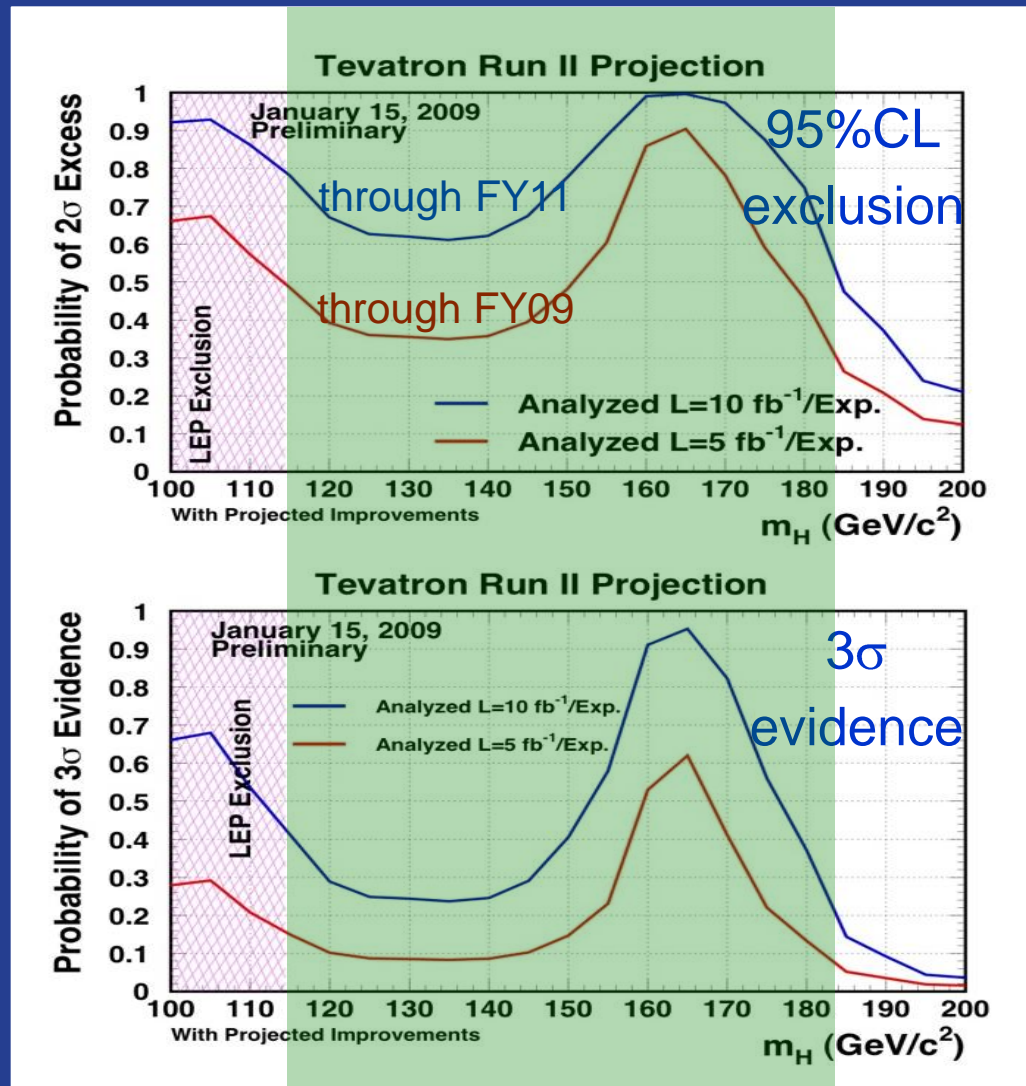


Search for the Higgs Particle

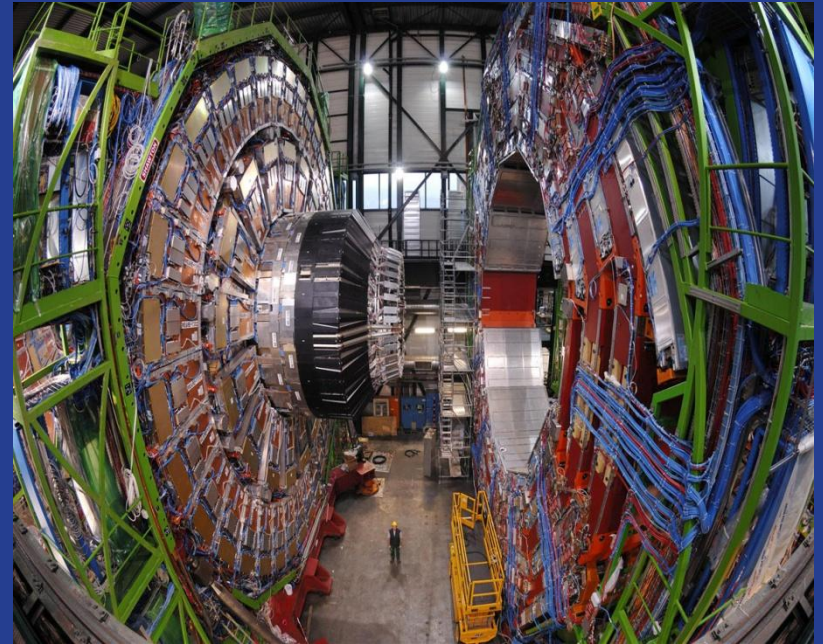


Prospects of the Tevatron on Higgs

- $> 9 \text{ fb}^{-1}$
so far
- $\sim 12 \text{ fb}^{-1}$
by FY11

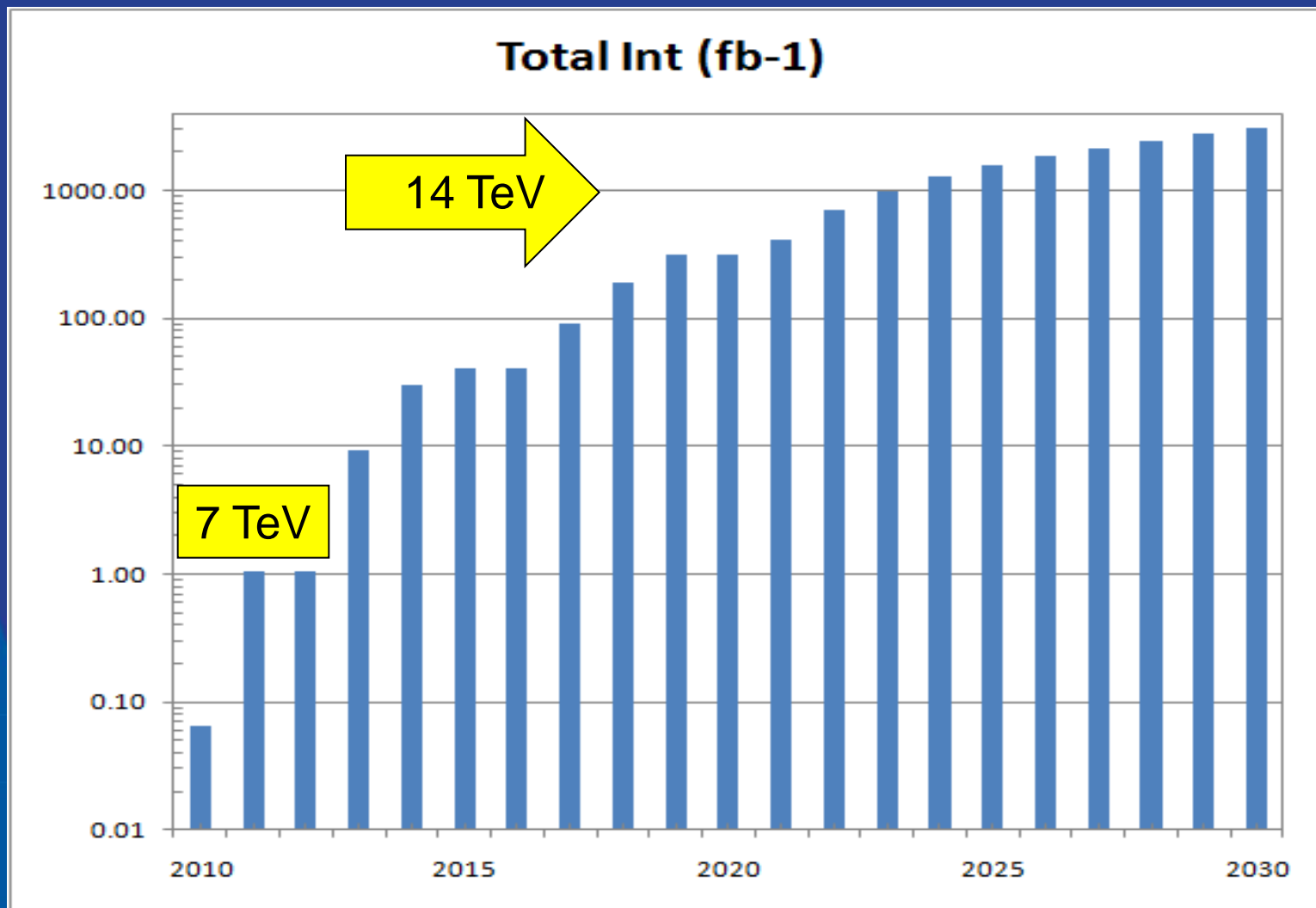


Energy frontier will move to the LHC

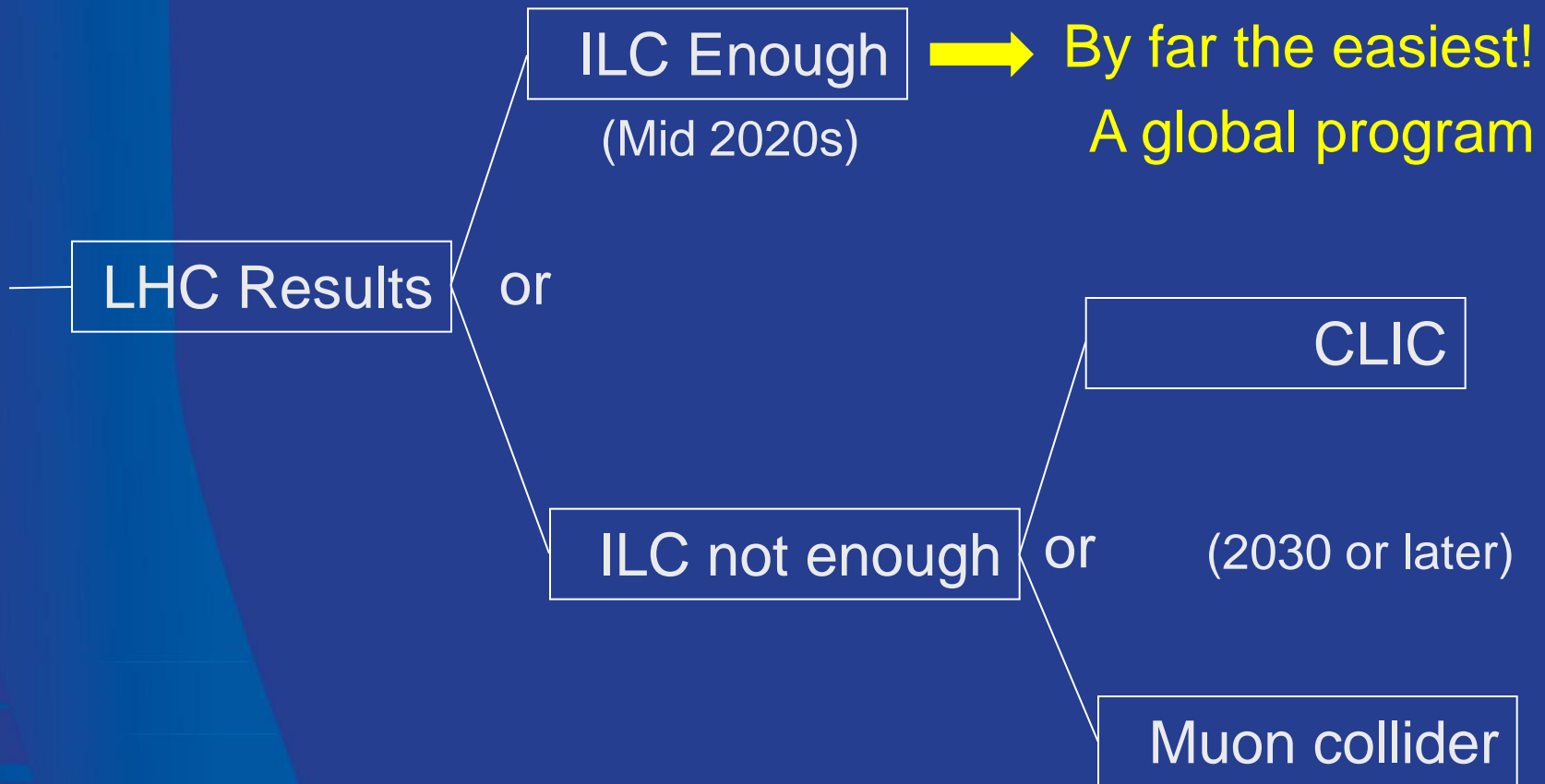


Fermilab is the lead US lab on the accelerator and the only US lab in CMS supporting over 50 universities

LHC

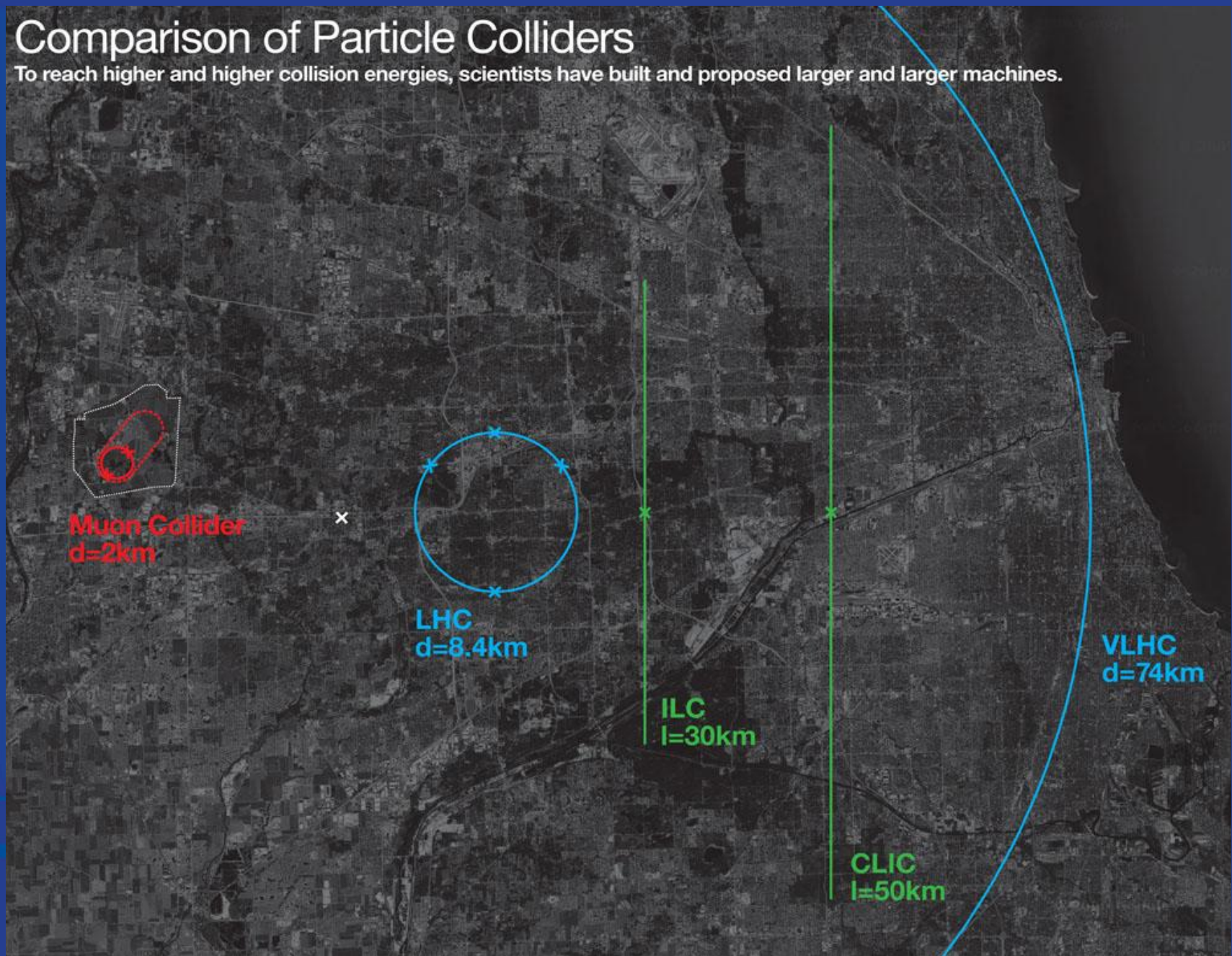


Biggest decision of the decade !



Comparison of Particle Colliders

To reach higher and higher collision energies, scientists have built and proposed larger and larger machines.



Mid-term Future: Major Enhancement at the Intensity Frontier

Start with
Accelerator Shutdown
March 2012 – February 2013
for installation/commissioning of neutrino beam upgrade
(300 kW \rightarrow 700 kW)

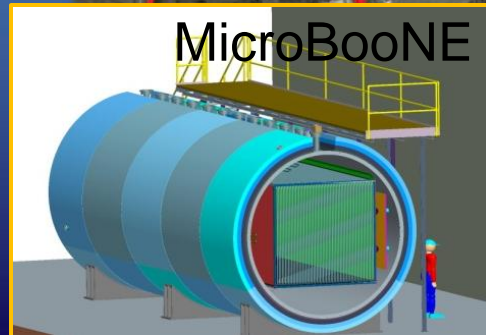
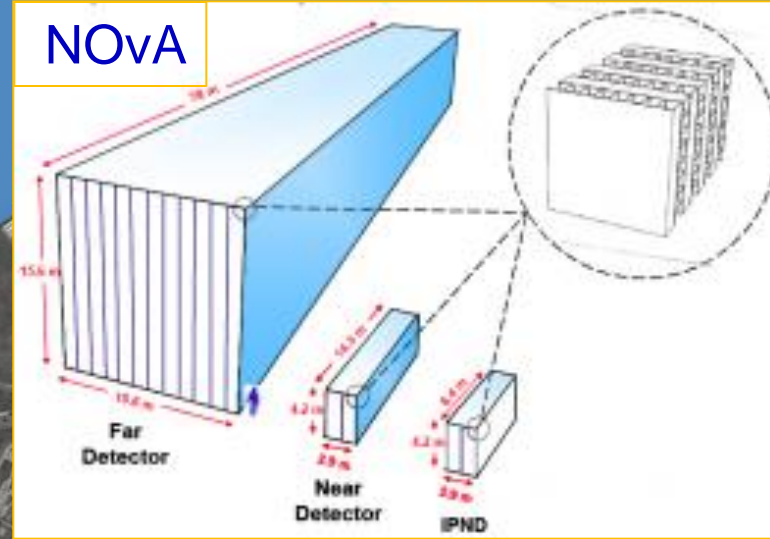
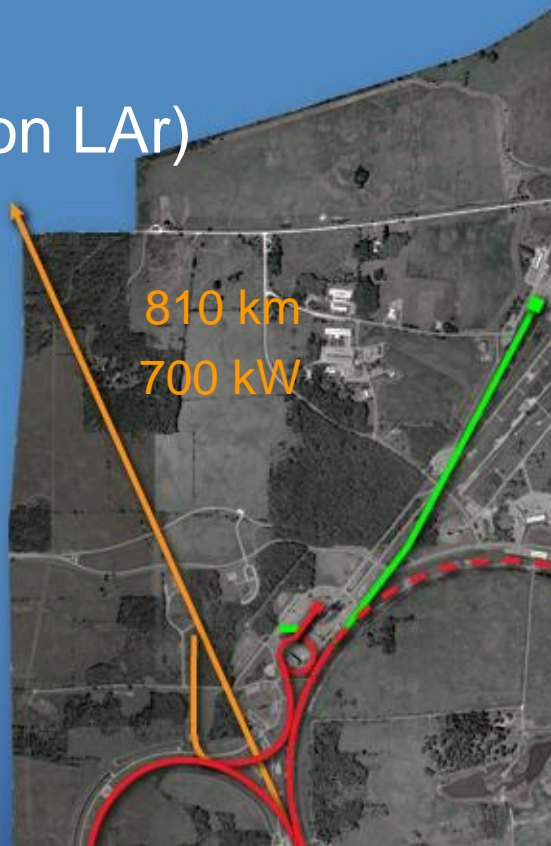
NOvA Detector Construction & Installation
Plan: MicroBooNE Detector Construction & Installation

Neutrinos

NOvA (off-axis)

MINERvA

MicroBooNE (170 ton LAr)



Accelerator-Based Neutrinos



Fermilab → Soudan (735km)
Fermilab → Ash river(810km)
300 kW (now)
→ 700 kW (being upgraded)

CERN → Gran Sasso (732km)

J-PARC → Kamioka (295km)

~50 kW (now) → 400 kW
→ 750 kW (to be upgraded)

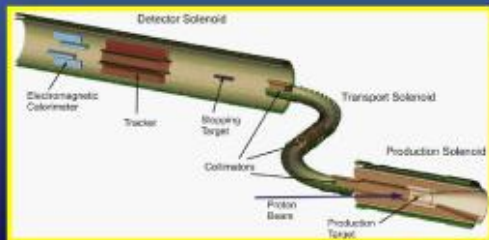
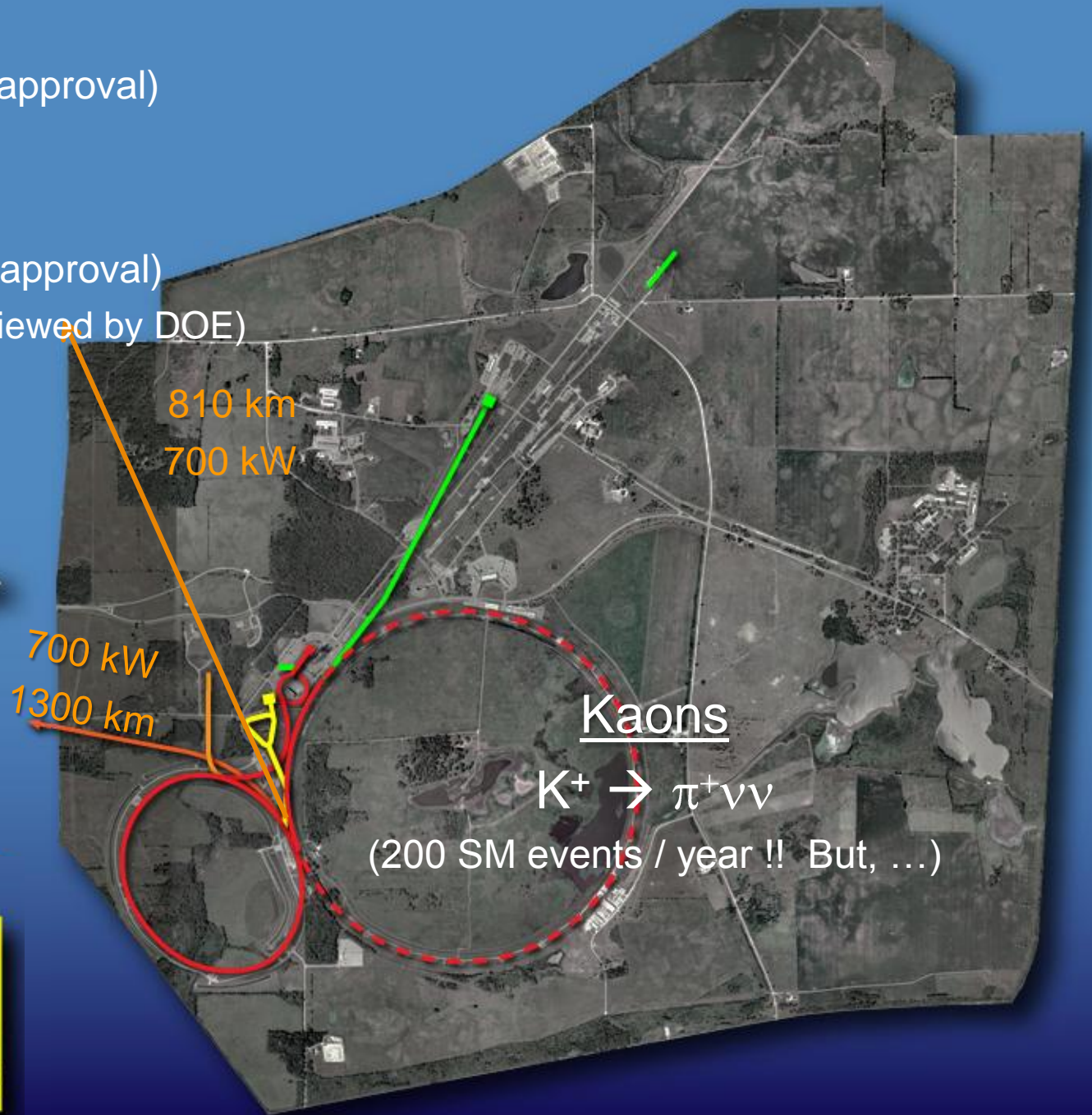
Neutrinos

LBNE (DOE Stage-1 approval)

Muons

Mu2e (DOE Stage-1 approval)

Muon g-2 (Being reviewed by DOE)



Long Baseline Neutrino Experiment

Neutrinos, Proton Decays, Neutrino Astrophysics, ...
(DOE – NSF Joint Project)

LBNE collaboration:
262 Scientists and Engineers
from 59 Institutions / 4 countries
And still growing !

1300 km

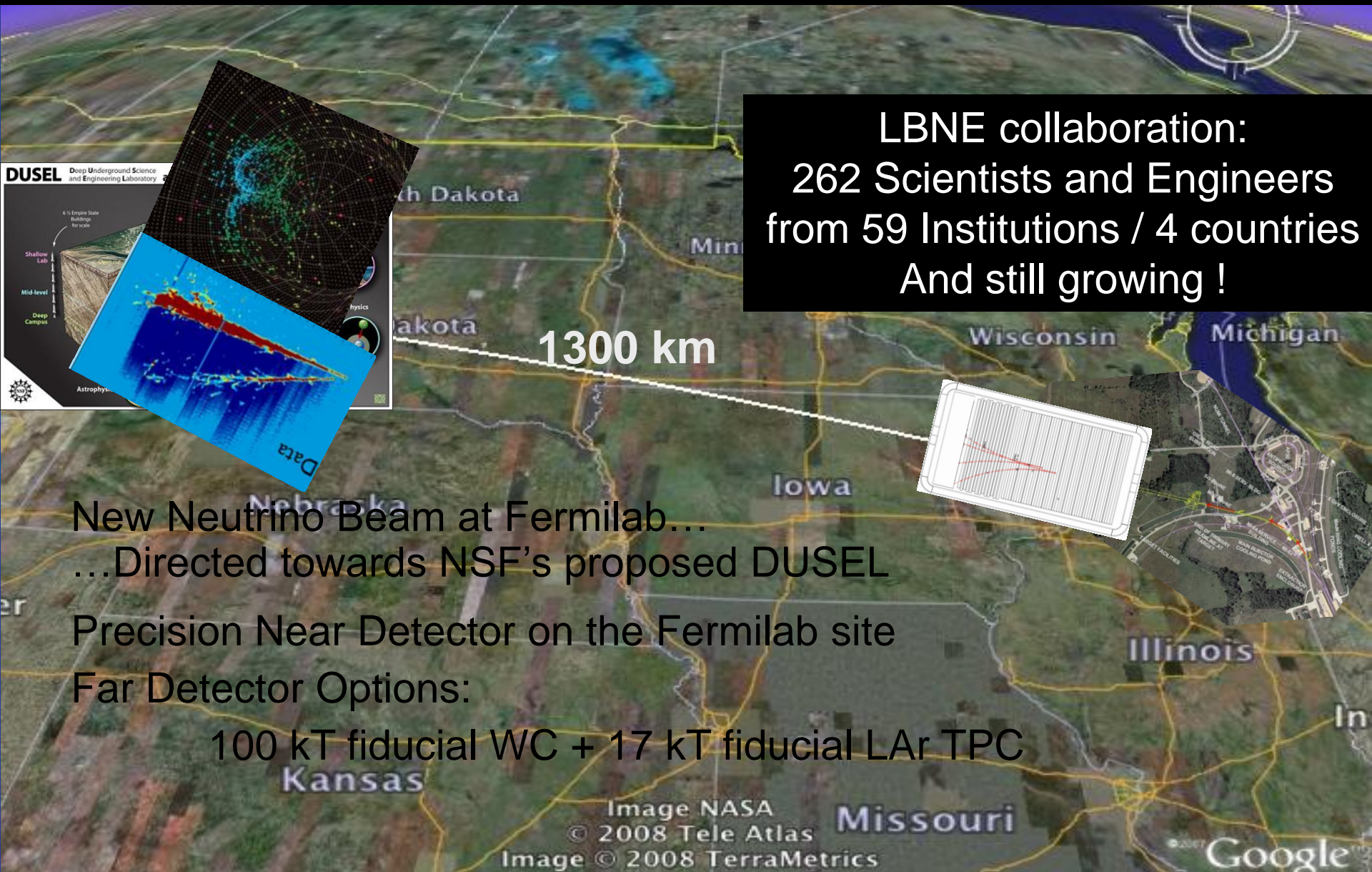
New Neutrino Beam at Fermilab...

...Directed towards NSF's proposed DUSEL

Precision Near Detector on the Fermilab site

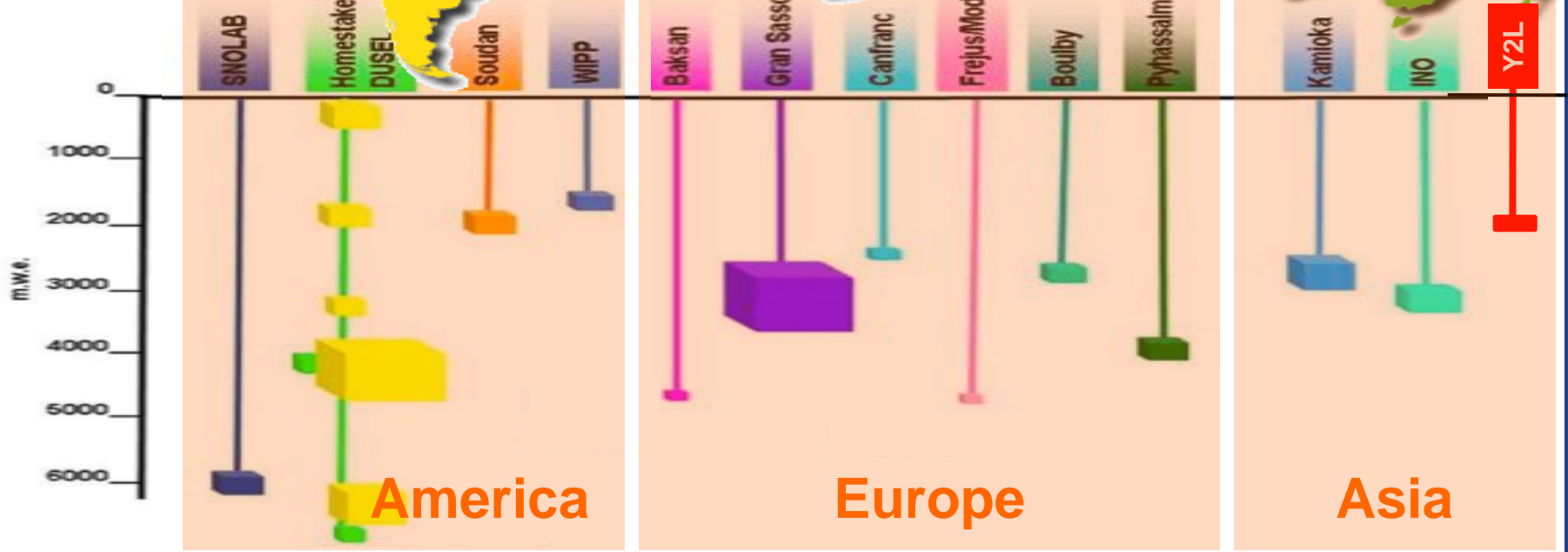
Far Detector Options:

100 kT fiducial WC + 17 kT fiducial LAr TPC

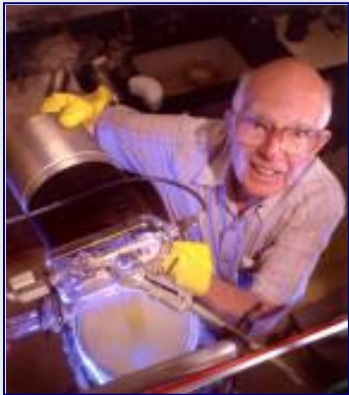
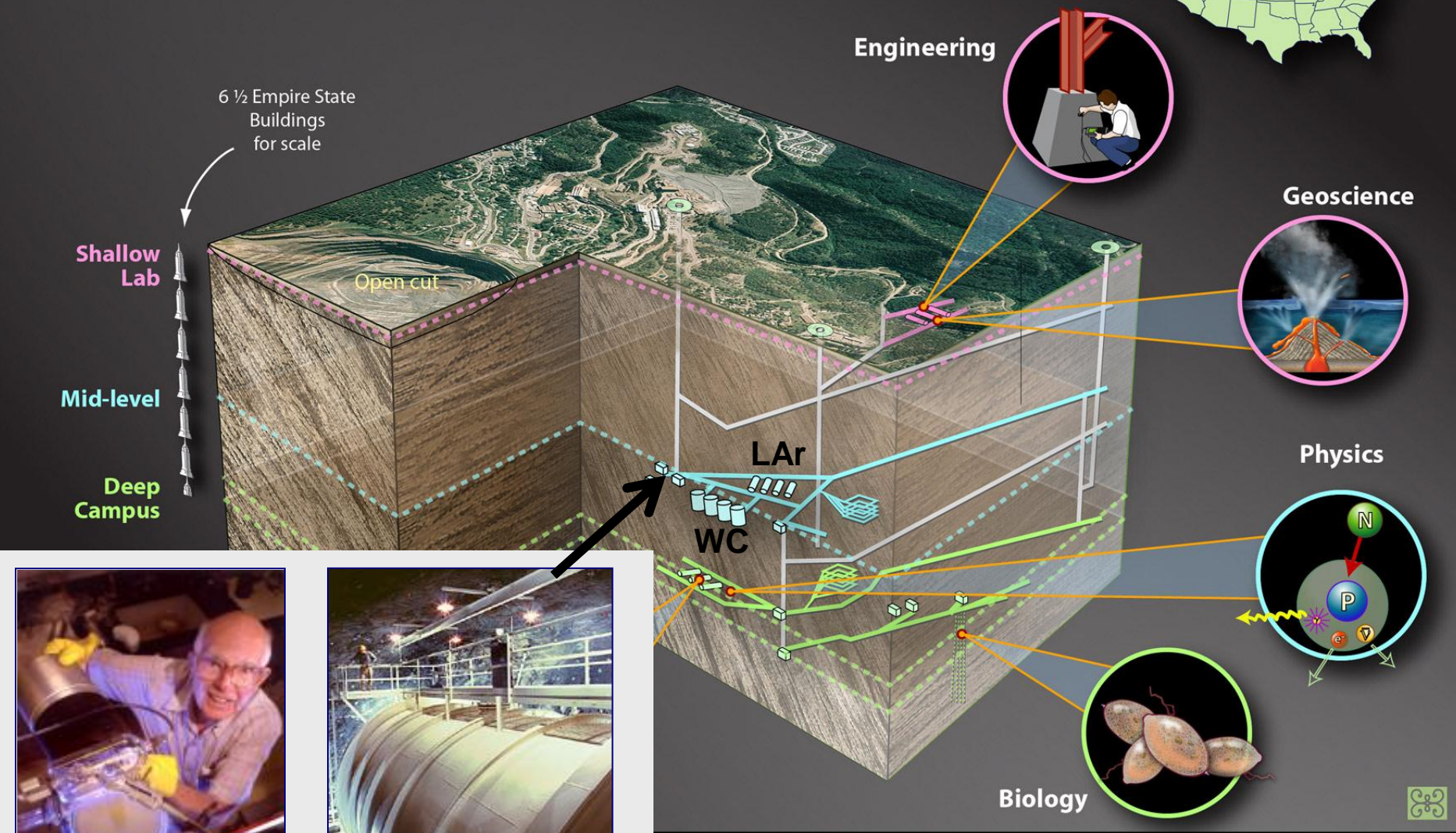


Existing & Potential Underground Laboratories

for neutrinos, proton decays, dark matter searches



DUSEL Deep Underground Science and Engineering Laboratory at Homestake, SD



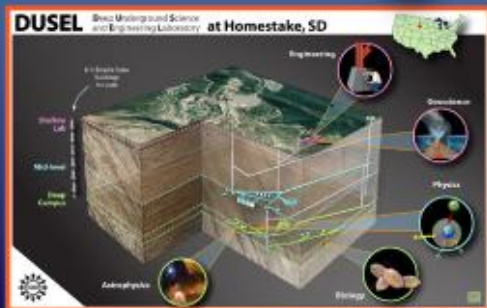
Ray Davis's Experiment

Neutrinos with Project X

multi MW beam

large detector (a few 100 kton)

long distance ($> 1,200$ km)



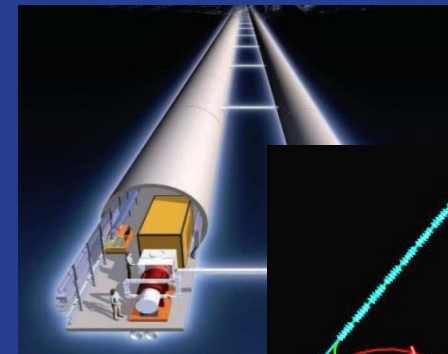
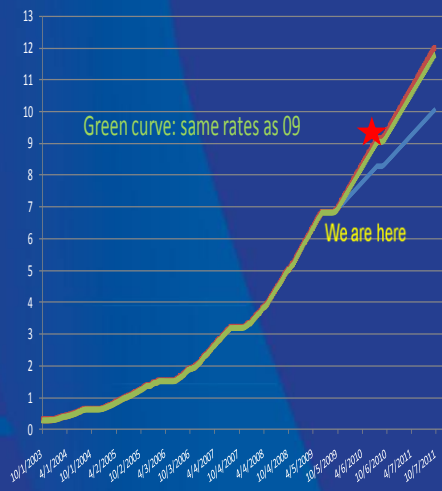
Project X provides:
neutrinos
muons
kaons
nuclei



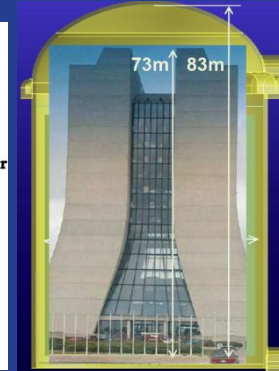
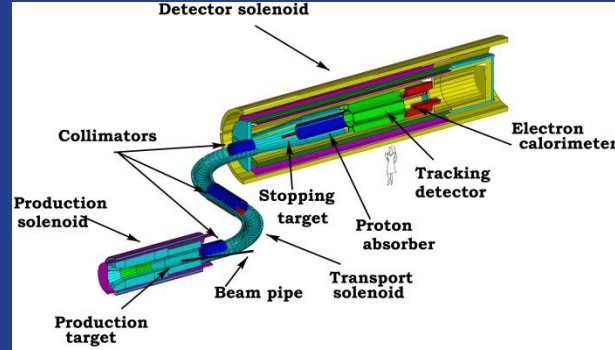
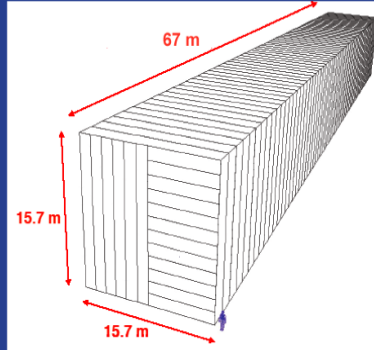
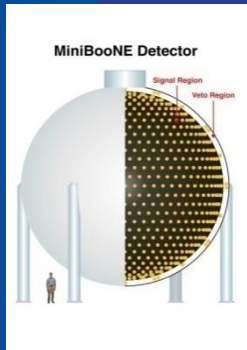
Energy frontier strategy

Energy

Tevatron LHC	LHC	LHC Upgrades ILC??	LHC ILC, CLIC or Muon Collider
-----------------	-----	-----------------------	--------------------------------------



Intensity frontier strategy



Intensity

MINOS
MiniBooNE
MINERvA
SeaQuest

NOvA
MicroBooNE
g-2?
SeaQuest

LBNE
Mu2e

Project X+LBNE
 μ , K, nuclear, ...
 ν Factory ??

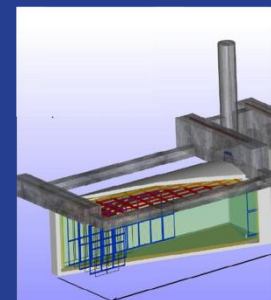
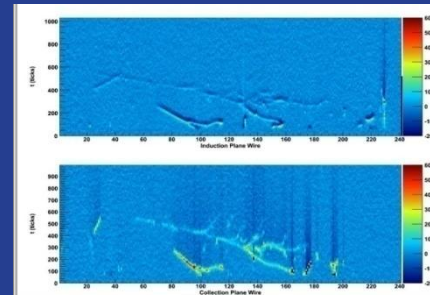
Now

2013

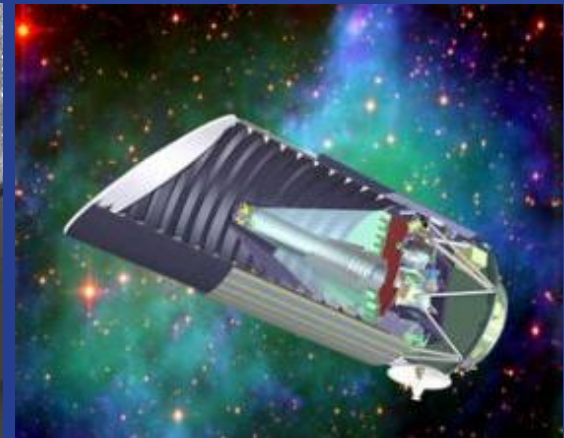
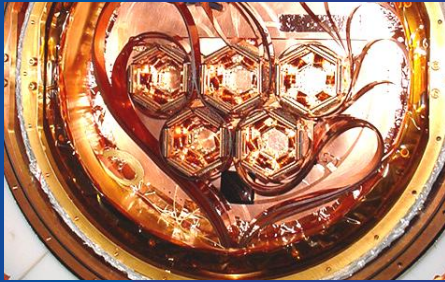
2016

2019

2022



Cosmic frontier strategy



Cosmic

DM: ~10 kg DE: SDSS P. Auger	DM: ~100 kg DE: DES P. Auger North?	DM: ~1 ton DE: JDEM, .. Holometer?	DE: JDEM, ...	
Now	2013	2016	2019	2022

Fermilab Strategic Plan at the Three Frontiers

time →

Energy
Frontier

Tevatron
(2011)

LHC / LHC Upgrades

ILC / μ Collider
(CLIC)

protons

technology
injector

Det./Phys. Synergy:
ILC/CLIC/ μ Collider

NuMI
(300kW)

(2013)
NuMI
(700kW)

Project X

injector

ν Factory

>2MW (60-120GeV) for ν
+3MW(3GeV)+200kW(8GeV)

Booster

MINOS

NOvA

LBNE (ν to DUSEL)

MINERvA

MINERvA

(Proton Decay)

MiniBooNE

MicroBooNE

Muon

SeaQuest

(μ g-2)

Mu2e

Kaon, Nuclear, ...

Intensity
Frontier

Cosmic
Frontier

DM: CDMS/COUPP/(DarkSide)

(~10 kg → ~100 kg → ~ ton scale)

DE: (SDSS)

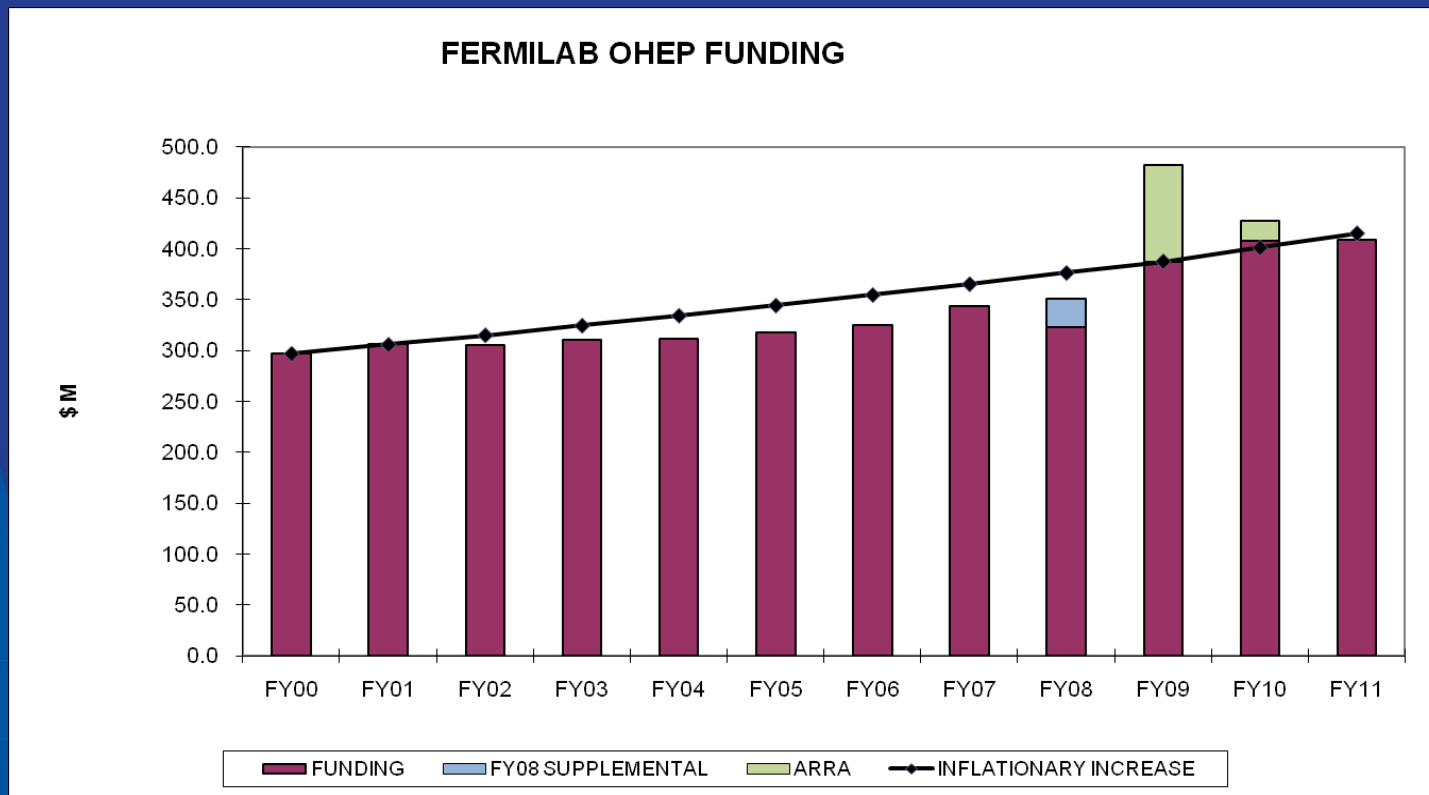
DES

JDEM or 4th gen DE

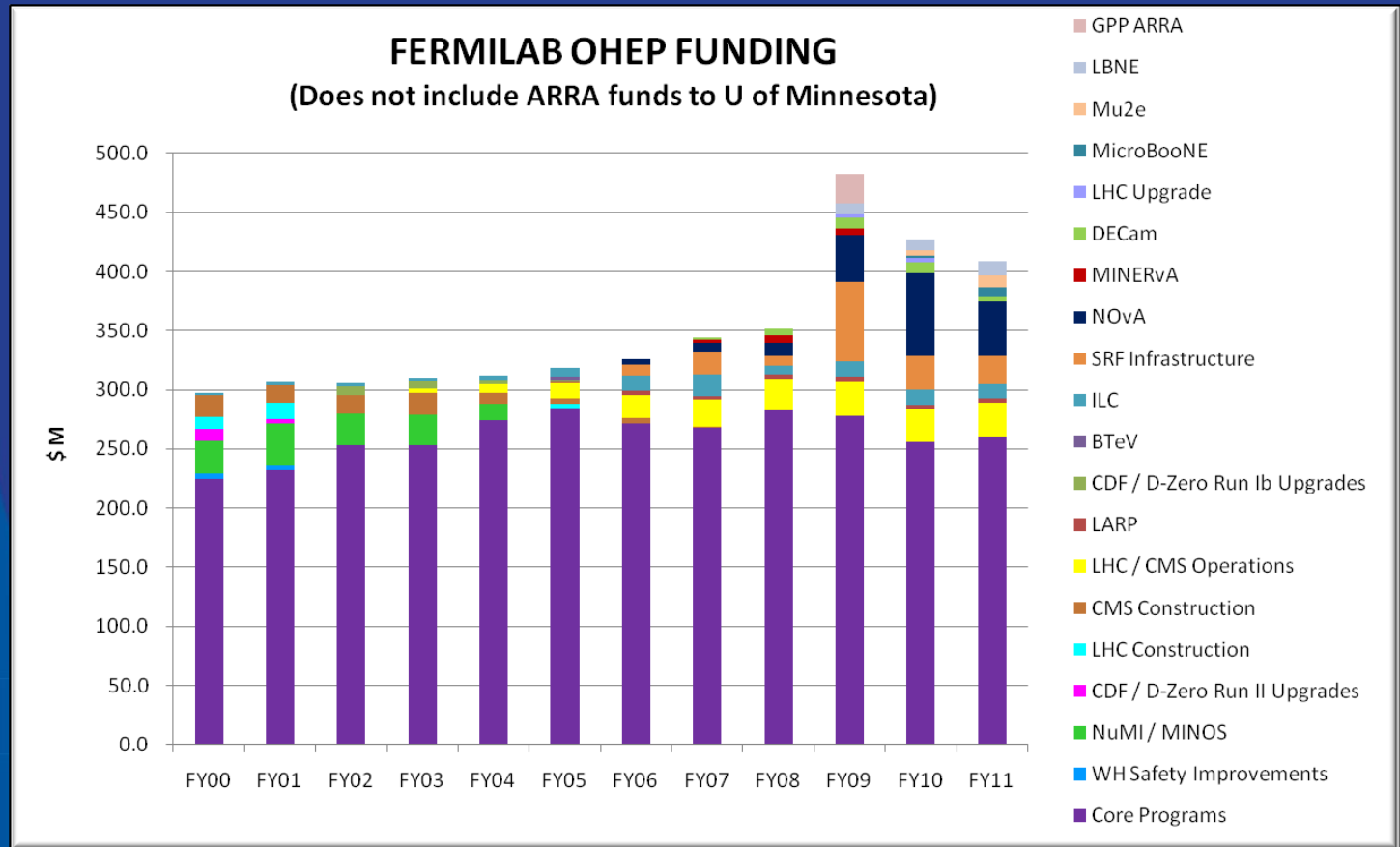
UHE Cosmic: Auger South

Auger North (TBD)

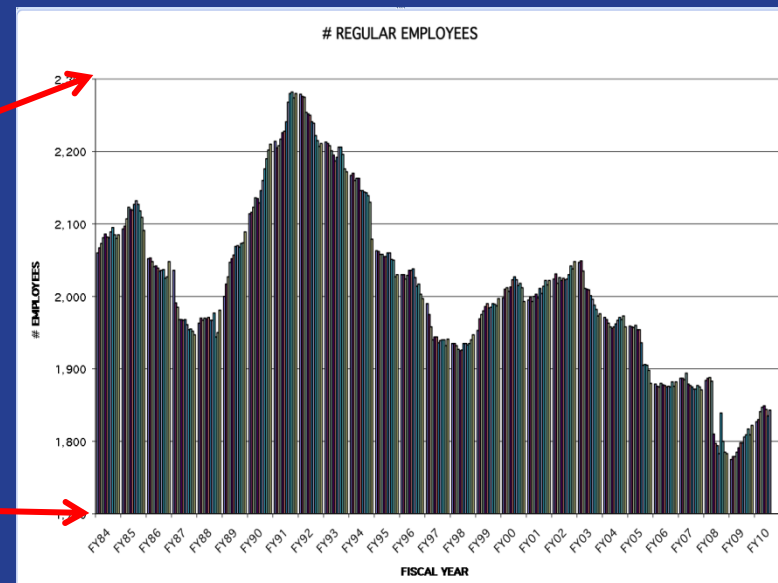
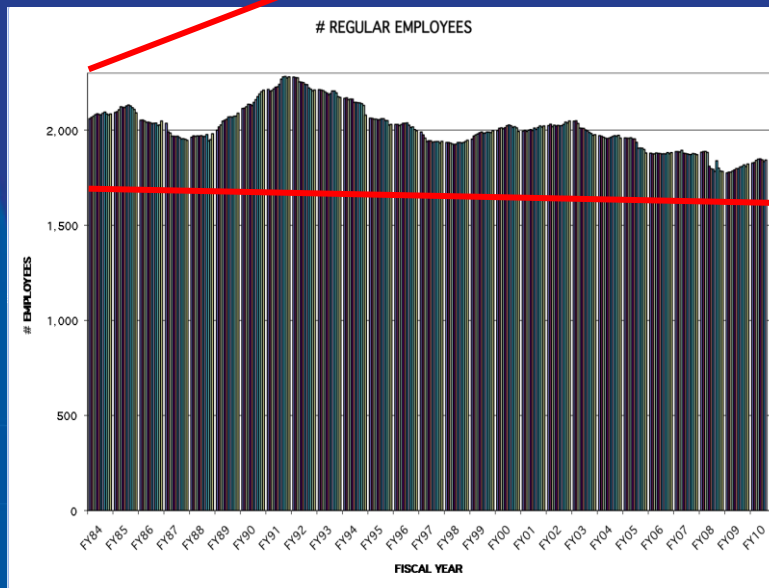
Funding as a function of time



Funding by categories

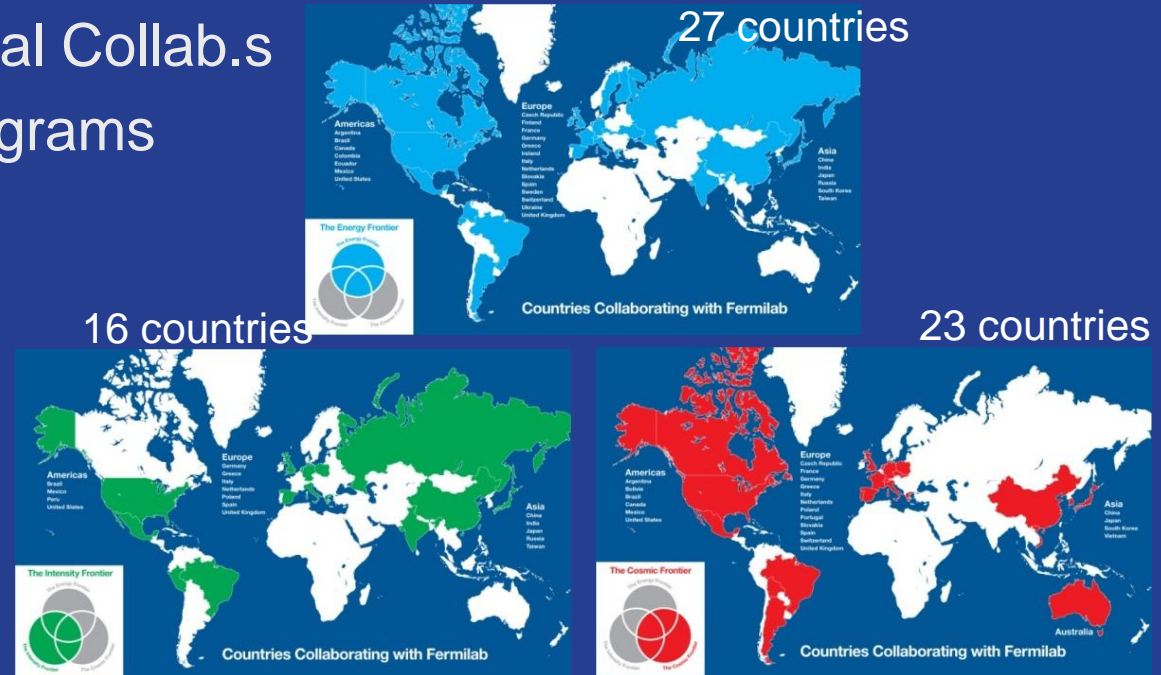


Regular employees vs. time



Collaborative Efforts

- International Collab.s for our programs



- Collaboration among DOE laboratories
 - Project X, ILC/SRF, Muon collider, neutrino factory, LHC Accelerator, many particle experiments, ...
- Argonne-UChicago-Fermilab Collaboration

Argonne – UChicago – Fermi Collaboration Meetings

- Since Nov. 2006

<http://www.fnal.gov/directorate/ANL-UC-FNAL-Collab/>

Date	Location	Date	Location
1 st : Nov. 29, 2006	Argonne	5 th : Feb. 2, 2009	Argonne
2 nd : May 14, 2007	Fermilab	6 th : Oct. 12, 2009	UChicago
3 rd : Nov. 27, 2007	Argonne	7 th : Jun. 7, 2010	Fermilab
4 th : Jun. 27, 2008	Fermilab	8 th : Dec. 7, 2010	Argonne

- Topics for the 8th meeting (Dec. 7, 2010 at Argonne)
 - Office of Communication, Computing, Accelerator Research, Cosmic Frontier Strategy
- Argonne year-long gate passes for Fermilab collaborators

Education (K-12, undergrads, public)

http://www.fnal.gov/pub/education/k-12_programs.html

- NSF, DOE, Fermilab Friends, Fee-based cost recovery
- CY2009: 45,390 teachers, students, general public

Regular teacher workshop: 98

Summer interns: 55

Summer teachers: 22

Students field trip: 8,693

Science adventure classes: 1,655

Visitors to science center: 3,011

Tours: 3,357 students; 127 teachers; 7,760 public

Classroom presentation: 14,689

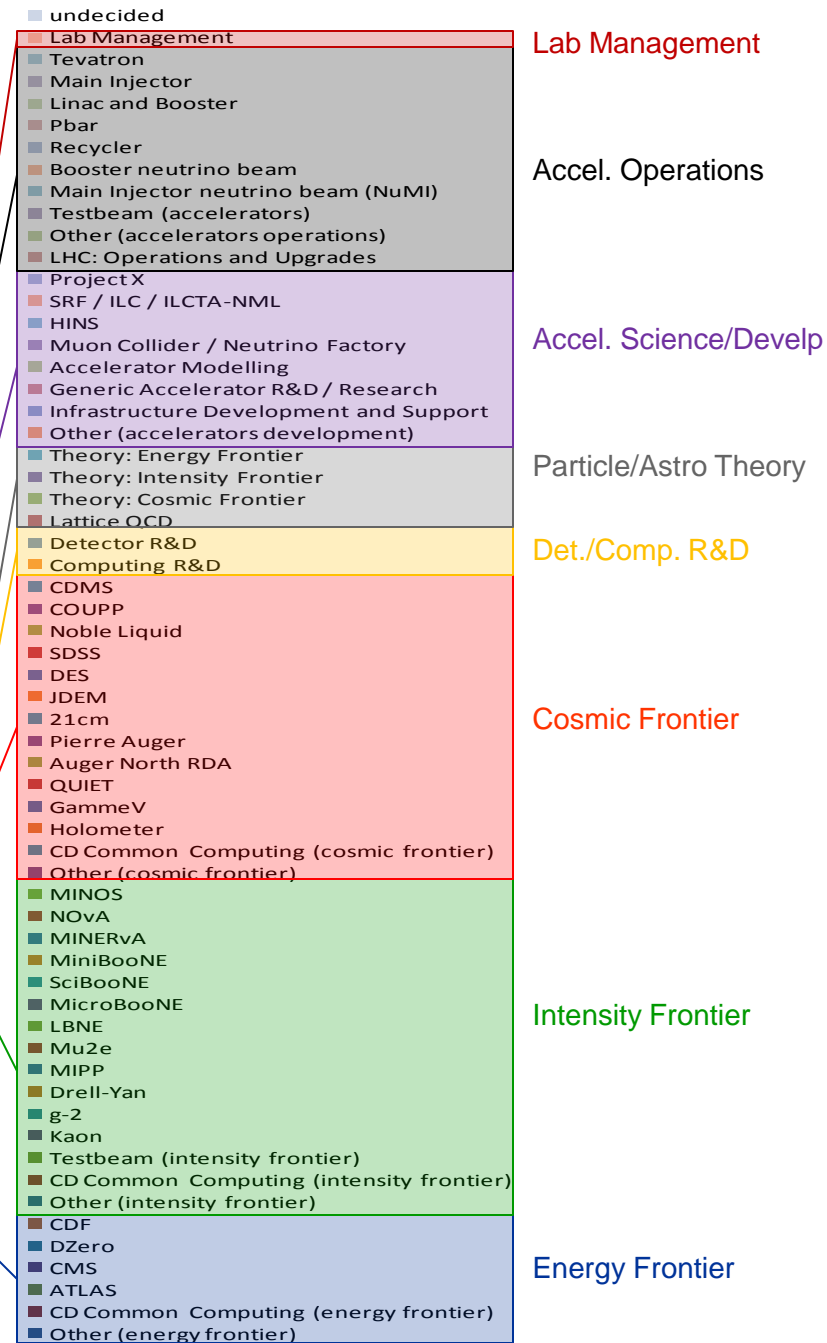
Science Chicago Fest: 6,000

.....

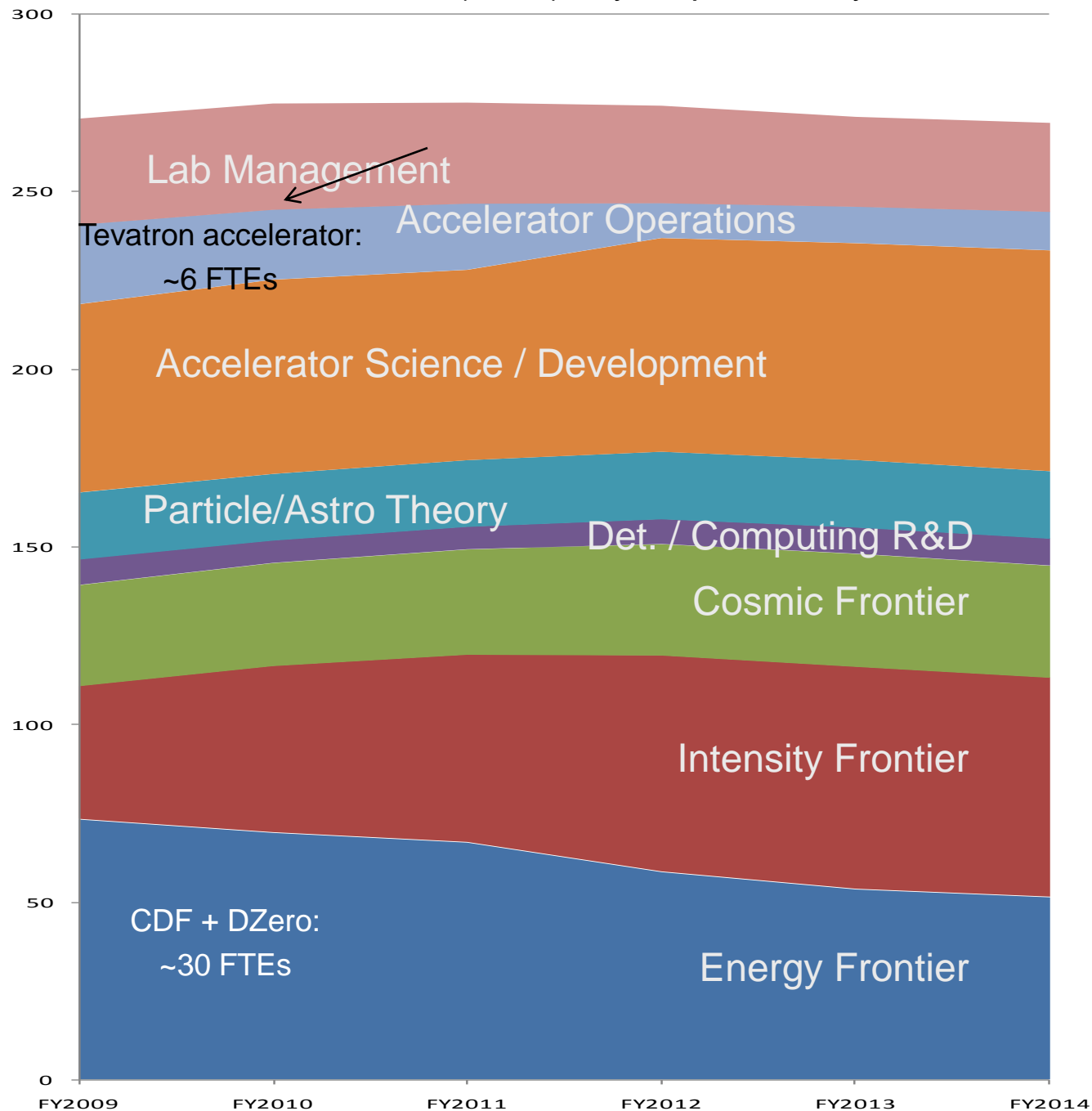


Appendix A: Workforce Planning

New hires in neutrinos

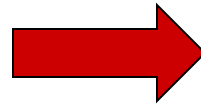
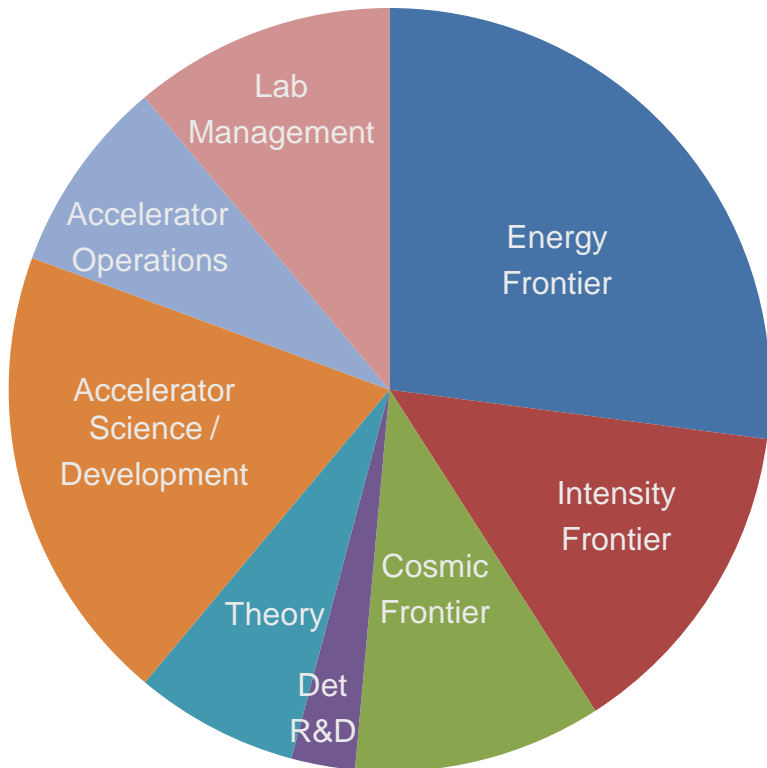


Scientist Efforts (FTEs): 5-year plan survey

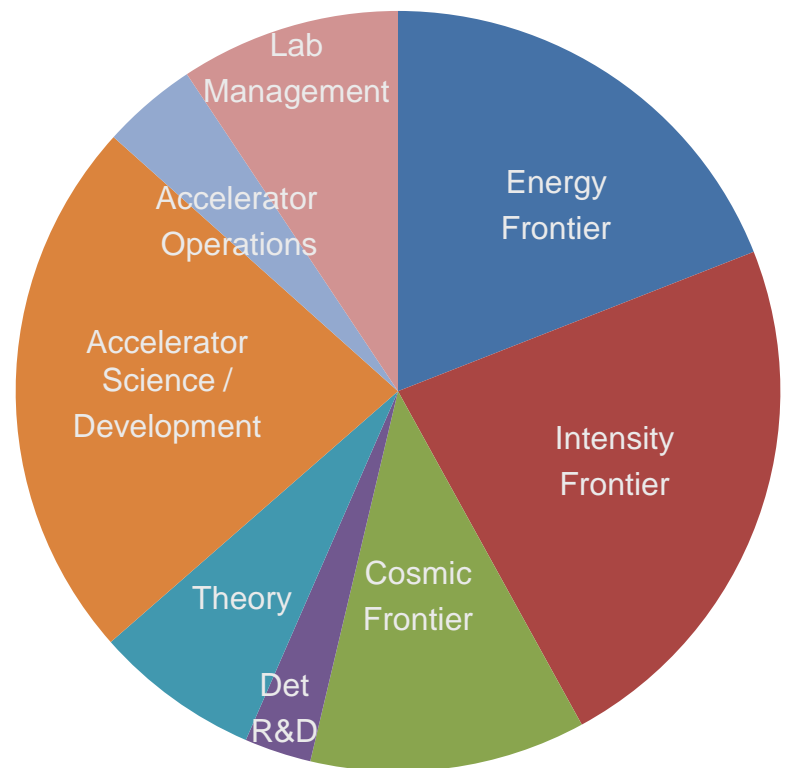


Scientists Efforts (FTEs): 5 year plan survey

FY 2009



FY 2014



Positions filled

- Vicky White appointed Associate Laboratory Director for Computing Science and Technology and CIO
- Stuart Henderson to start August 16th as Associate Director for Accelerators
- Steve Holmes will be full time leader of Project X
- Successful recruiting efforts for early career positions: for example Wilson Fellows with more than 90% of offers accepted

Appendix B: Core competencies

The three core competencies of the laboratory
are defined by the DOE and are further
analyzed in this appendix

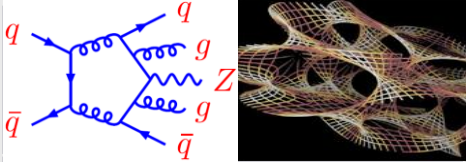
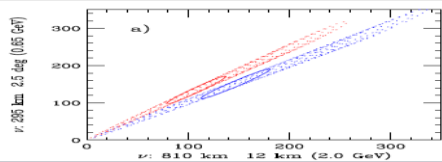
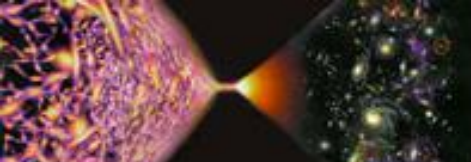
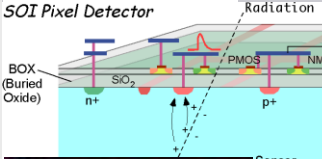
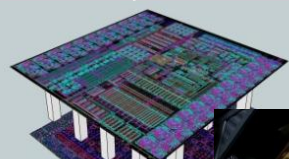




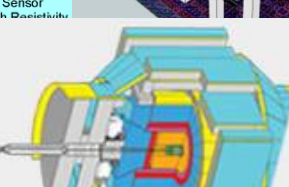
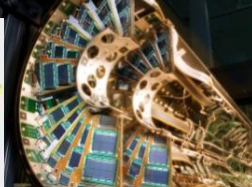

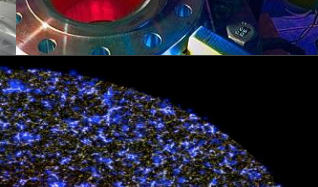
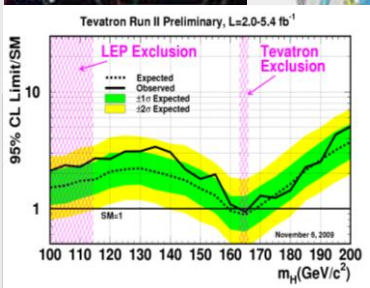
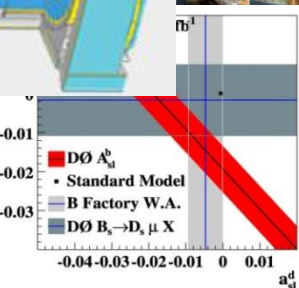
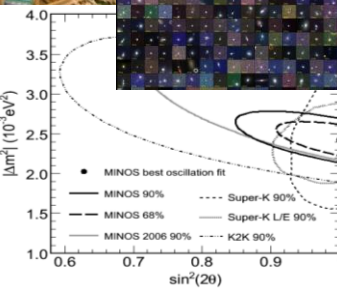
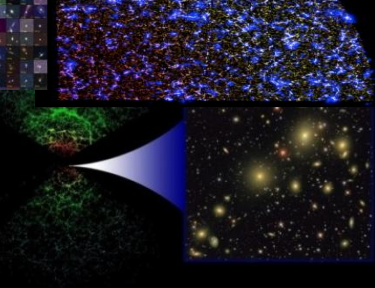
Competencies, investment and mission

	Energy Frontier	Intensity Frontier	Cosmic Frontier
Particle Physics	11%	6%	4%
Accelerator Science	13%	6%	0%
Large Scale User Facilities	33%	25%	2%

World class skills → core capabilities

Skill	Particle Physics	Accelerator Science	Large Scale User Facilities
Theory	✓	✓	✓
Accelerator Technologies		✓	✓
Advanced Instrumentation	✓	✓	✓
Simulation	✓	✓	✓
Data Analysis & Distributed Computing	✓	✓	✓
Systems Integration & Operations			✓
Project Management			✓

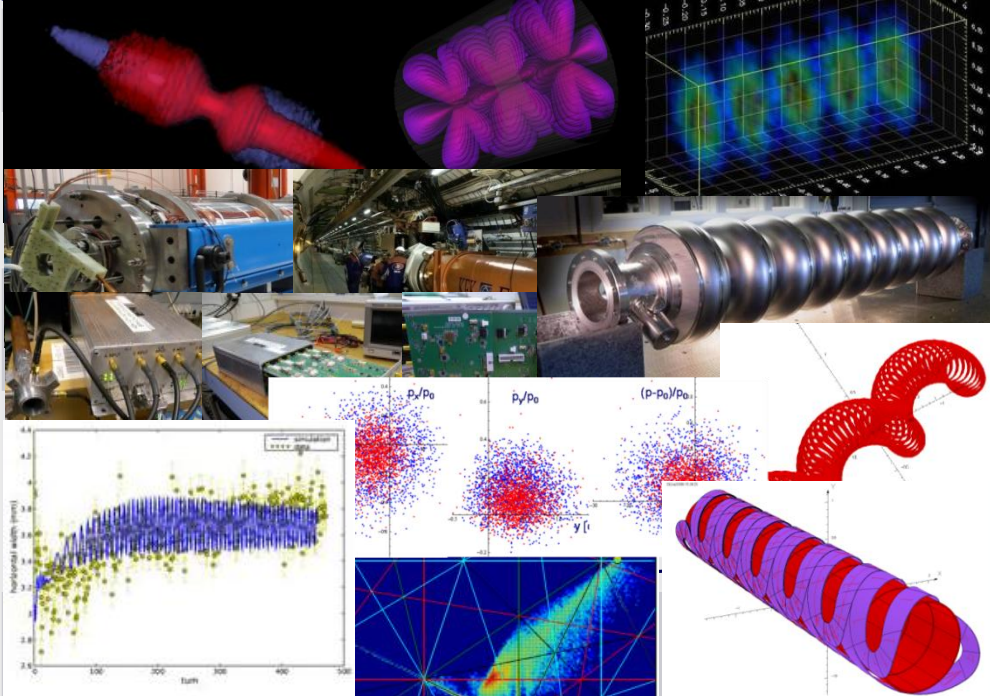
World class skills → Particle Physics

Particle Physics: Skill	Energy Frontier	Intensity Frontier	Cosmic Frontier
Theory			
Advanced Instrumentation	 	 	
Simulation	 	 	
Data Analysis & Distributed Computing		 	

World class skills → Particle Physics

Particle Physics: Skill	Energy Frontier	Intensity Frontier	Cosmic Frontier
Theory	QCD, Beyond Standard Model, Monte Carlo Generator	Matter dominated universe, rare processes, Neutrino Mixing	Phenomenology and analysis of cosmic frontier experiments
Advanced Instrumentation	Silicon Vertex detectors, 3D ASIC Design	Liquid Argon TPC	Cryogenic detector Bubble chambers CCD packaging Laser Cavities
Simulation	Simulation for lepton and hadron colliders, GEANT4 detector simulation, Lattice QCD	Neutrino simulation (a various kinds of detectors) Muon simulation	Large scale cosmological simulation
Data Analysis & Distributed Computing	Analysis of large Tevatron and LHC datasets, World-wide collaboration	Understanding low energy nuclear interactions and flux, World-wide collaboration	Management of data intensive cosmic surveys (SDSS, DES, JDEM, ...)

World class skills → Accelerator Science

Accelerator Science: Skill	Energy Frontier	Intensity Frontier	Cosmic Frontier
Theory			
Accelerator Technologies			
Advanced Instrumentation			
Simulation			
Data Analysis & Distributed Computing			

World class skills → Accelerator Science

Accelerator Science: Skill	Energy Frontier	Intensity Frontier	Cosmic Frontier
Theory	Collider beam dynamics (beam-beam, IBS, etc)	Instabilities, loss mitigation (energy deposition)	
Accelerator Technologies	SC Magnets (Nb ₃ Sn, HTS), SC RF ($\beta=1$), RF power	SC RF ($\beta<1$), Particle Sources, RF power	
Advanced Instrumentation	Beam diagnostics and feedback	Beam diagnostics and feedback	
Simulation	Integrated accelerator simulations (Synergia, Muon Collider), Energy Deposition (MARS)	Integrated accelerator simulations (Synergia, Muon Collider) Energy Deposition (MARS)	
Data Analysis & Distributed Computing	Shot Data Analysis		

World class skills → Large Scale User Facilities

Large Scale User Facilities: Skill	Energy Frontier	Intensity Frontier	Cosmic Frontier
Theory	Lattice QCD	QCD National Facility	
Accelerator Technologies			
Advanced Instrumentation			
Simulation			
Data Analysis & Distributed Computing			
Systems Integration, Operations, Project Management			

World class skills → Large Scale User Facilities

Large Scale User Facilities: Skill	Energy Frontier	Intensity Frontier	Cosmic Frontier
Theory	Lattice QCD National Facility	Lattice QCD National Facility	Cosmological Computing
Accelerator Technologies	NML Accel Test Facility, MuCOOL Test Area, Muon Collider, ILC	NML Accel Test Facility, NuMI, LBNE, Mu2e, Project X, Neutrino Factory	
Advanced Instrumentation	Silicon Detector Facility Center	LAr R&D Facility, Extruded Scintillator Facility	LAr R&D Facility, Silicon Detector Facility Center (DES CCD packaging)
Simulation			
Data Analysis & Distributed Computing	LHC Physics Center, Open Science Grid, CMS Tier-1 Center, Advanced Network, Massive Data Storage	Open Science Grid	Survey Data Archive
Systems Integration, Operations, Project Management	Tevatron Complex, CDF/DZero detectors, LHC Remote Oper. Center, Testbeam	NuMI & BNB (ν beams), Neutrino detectors, Soudan Underground Lab, Testbeam / small expt.s	Testbeam, Soudan Underground Lab., Silicon Detector Facility Center, Pierre Auger

Appendix C: Performance to Date (Notable Outcomes)

Describes the notable outcomes contained in our contract by which the performance of the laboratory is judged on a yearly basis

Performance To Date

- Expect to meet all “Notable Outcomes”
- “Beyond Notable Outcomes”
 - Towards one laboratory system integration
 - Lab’s strategic plan, workforce planning, 10 year facility plan, master plan, lab-wide work breakdown structure, time and labor system, human resources database, project management software, engineering manual
 - Better working place
 - Focus groups (10% staff + users) and recommendations
 - Employee advisory group as a sounding board for proper implementation
 - Certified
 - EVMS, Towards ISO20000

Goal 1.0, 2.0, and 3.0

Obj	Notable Outcome	Status / Projection
1.1	CDF and D-Zero will improve the exclusion limits on the allowed mass of a standard model Higgs Boson, and continue to study the most pressing Standard Model issues accessible at the Tevatron	On track: in FY2010 so far • New Higgs limits • 80 new results
2.1	The Long Baseline Neutrino Experiment will make satisfactory progress toward CD-1 as determined by a peer review held in FY 2010	Significant progress made; Director's Review in July to evaluate CD-1 preparations
2.2	The NOvA Project continue to progress towards completion on time and with budget.	CD-3b in Oct 2009; DOE OECM rating from yellow to green in Nov. 2009; Expect to be complete complete on time and with budget
2.3	The Tevatron and NuMI will deliver at least as much data as in FY2009	• Tevatron – on track • NuMI – already achieved
3.2	The Laboratory will make progress in matching their staffing to the needs of the planned program.	On track: Lab-wide annual process "OHAP (Organization and Human Asset Plan)" as a tool

Goal 4.0

Obj	Notable Outcome	Status / Projection
4.1	Lab leadership will develop a strategic plan for the future scientific & technical activities of the Lab, which aligns with the Office of Science and Department goals, and a detailed strategy for executing the plan during the next 2-5 years.	The strategic plan documented, made publicly available; Implementing this plan together with DOE HEP; OHAP – staffing plan to support the strategic plan (Objective 3.2)
4.2	Lab. leadership will make significant progress in defining and implementing its contractor assurance system. It is expected that a collaborative and uniform approach to this issue among all contractors will be evident.	On track: Completed <ul style="list-style-type: none"> • Root Cause Analysis Training & Graded Approach • Suspect/Counterfeit Program • Lessons Learned Program • Corrective Action / Preventive Action Procedure • Management (Self) Assessment Procedure • Science As-Is Assessment
4.3	The contractor will fill all key leadership positions at the Lab in a timely manner.	Appointed: <ul style="list-style-type: none"> • AD for Computing, Science & Technology / CIO • AD for Accelerators In search: Head of OPMO

Goal 5.0

Obj	Notable Outcome	Status / Projection
5.1	Maintain ISO 14001 & OHSAS 18001 Registrations, as evidenced by successful completion of third-party surveillance audits conducted roughly every six months.	Surveillance audit in Oct. 09 Recertification audit in Jun. 10 Many new Initiatives
5.2	Meet planned FY2010 milestones contained in the Corrective Action Plan that is being developed in response to the Mar 2009 Accelerator Safety Review.	<ul style="list-style-type: none"> • 3 of 4 corrective actions completed on or ahead of schedule • The 4th's completion date is 2014.
5.3	In support of the Federal Electronics Challenge and the requirements of Executive Order 13423, reduce the environmental impact of using personal computers (including laptops), monitors and printers. During FY2010, establish formal policies & procedures on energy efficient computing. Procurements of computers for scientific programming will include energy efficiency in the evaluation criteria for the procurement. A baseline assessment of the Lab's EPEAT system performance will be conducted by the end of third quarter, FY 2010.	<p>Oct. 2009 – Jan. 2010: 88% purchase EPEAT registered</p> <p>Feb. 2010 – April 2010: 98% purchase EPEAT registered</p> <p>For large procurements, scientific computing energy efficiency was included in RFP – an awarded point in the bid evaluation process</p>

Goal 6.0

Obj	Notable Outcome	Status / Projection
6.1	Complete full implementation of the electronic Time and Labor System by the end of 3 rd quarter, 2010.	Adopted Kronos timecard Go-live late June
6.1	Efficiently and effectively manages all activities in conjunction with the ARRA funding in accordance with all rules and requirements. No significant OIG or FNAL Internal Audit findings will serve as the measurement of success in meeting this notable target.	Milestones met; Costing rate accelerating; Procurement kept up. IG report, CH review → no issues identified
6.2	Demonstrates the effectiveness of its procurement systems as evidenced by achieving a comprehensive score of 90 out of 100 on the DOE approved Procurement Balanced Scorecard.	Achieved so far (94/100); Expect to be 94 or 95 by end FY2010
6.3	Upgrade its vehicle fleet maintenance software from the current FOCUS database to the Sunflower Maintenance module, thereby replacing an unsupported system with a more modern system that is integrated with other Property management(Sunflower) software. This will ensure the long term viability of the fleet management system	Achieved
6.4	Design/implement a Succession Plan and Executive Pay Grade Structure for senior management positions (Deputy Director, COO/Associate Director, CFO, and CIOO) by the end of 4 th quarter, FY 2010.	<u>Succession Plan</u> expect to be done by June 2010. <u>Pay Grade Structure</u> implementation by July 2010
6.5	Completes scheduled FY2010 milestones and key activities identified in the DOE approved Quality Implementation Plan for an Integrated Quality Assurance program. Complete the start up of the Assessment Program and have it fully operational by the end of 3 rd quarter, FY2010, in addition to implementing the Lessons Learned Program by 2 nd quarter, FY2010	On track

Goal 7.0

Obj	Notable Outcome	Status / Projection
7.1	Update the FNAL Transformational Energy Action Management (TEAM) Executable Plan (EP) for FSO approval by the date specified in the DOE Guidance. FNAL will meet specific FY 2010 goals established in this EP.	EP updated and approved by the date requested All FY 2010 EP goals expected to be met
7.2	Develop a Mission Readiness Plan for FY2010 which includes participation in two peer reviews and the development of FNAL Mission Readiness policies and procedures. This plan will be implemented by the end of 3 rd quarter, FY2010.	Developed drafts of Director's Policy on planning that includes mission readiness, and a draft process for the Annual Lab Plan including the Facility Mission Matrix 3 Peer Reviews: ANL (Nov. 2009), PPPL(Jul.2010), TJNAF (Sep.2010)
7.2	Complete final designs and start construction on ARRA General Plant Projects (GPP) Augmentation covered under Work Authorization Number KA/CH14/9/ARRA-1, consistent with established milestones in the approved Project Operating Plans.	Final designs were completed, and construction is underway on 6 ARRA GPP projects All milestones have been met

Goal 8.0

Obj	Notable Outcome	Status / Projection
8.1	A joint FNAL/FSO review of the Emergency Management Program will be performed no later than the end of third quarter, FY 2010. Corrective actions and lessons learned will be developed as appropriate.	Review complete Revisited Continuity of Operations Plan, call lists, etc. Fall 2009 with H1N1 Recent event with fatality in Wilson Hall clearly tested the emergency program. Lessons learned are in progress
8.2	In accordance with the FNAL Corrective Action Plan Addressing S&S Cyber Security Findings, dated May 2009, all computers will be monitored using centrally managed tools to inspect the configuration for compliance with Microsoft Windows Workstation Class Baseline Security Configuration by the end of July 2010.	Tremendous progress made All milestones expected to be met
8.2	All FNAL employees responsible for handling PII will receive training by the end of first quarter, FY 2010, and a review will be conducted of all applications in the ES&H area to clarify the need to maintain and handle PII. A new set of security plans will be written and approved in response to this review by June 2010.	PII training – Achieved Extensive survey of all ES&H systems were carried out

Appendix D: ARRA Activities

<http://www.fnal.gov/recovery/>

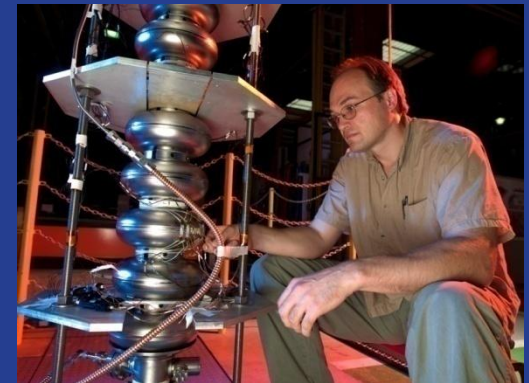
Contains a collection of pictures
from the American Recovery and
Reinvestment Act projects (see
Bruce Christman's presentation)

ARRA: NOvA



ARRA: SCRF

cavity fabricated
by joint venture of Roark and Niowave



Cryostats for SCRF Cavity Testing

ARRA: GPP (NML Extension)



ARRA: GPP (IB-3)



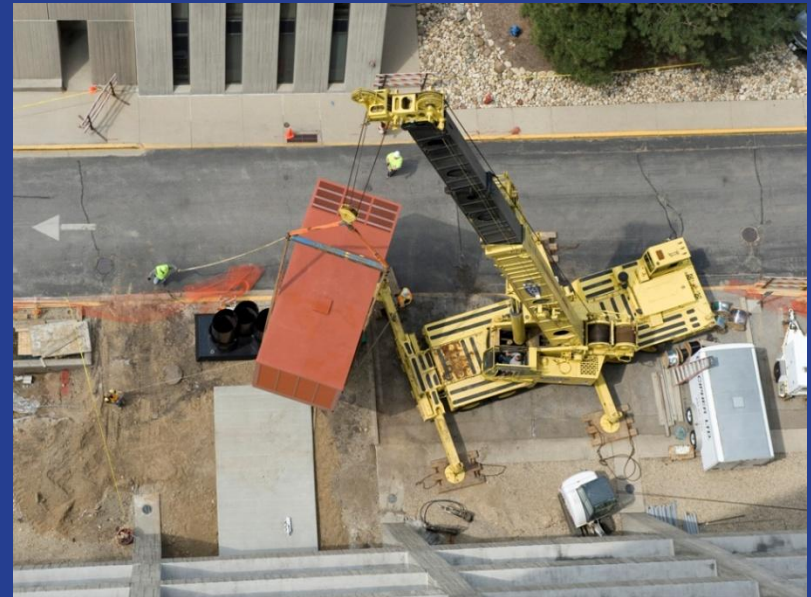
ARRA: GPP (MI-8)



ARRA: GPP (Feynman Comp. Center)



ARRA: GPP(Wilson Hall Generator)



ARRA: LBNE (Seismic Testing & Drilling)



Appendix D: IARC

The Laboratory has received a \$20M grant from the State of Illinois to establish the Illinois Accelerator Research Center incorporating the CDF building.

IARC

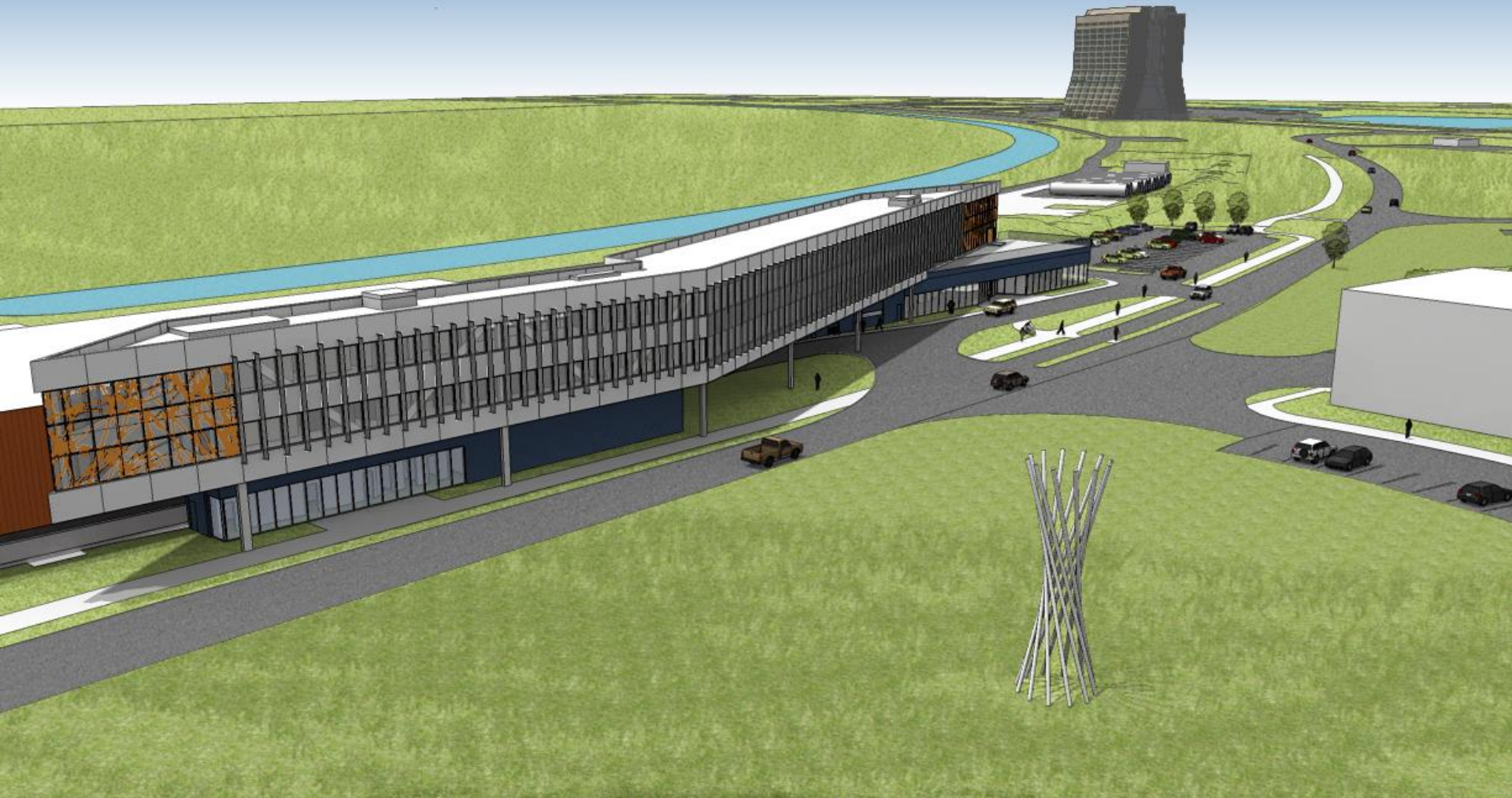
- Consists of three elements
 - Office, Education and Technical building
 - High Bay Space (existing CDF building)
 - Additional parking lots
- Will have physical connection to the CDF building and it is located in close proximity to the industrial area of the laboratory

view from northwest



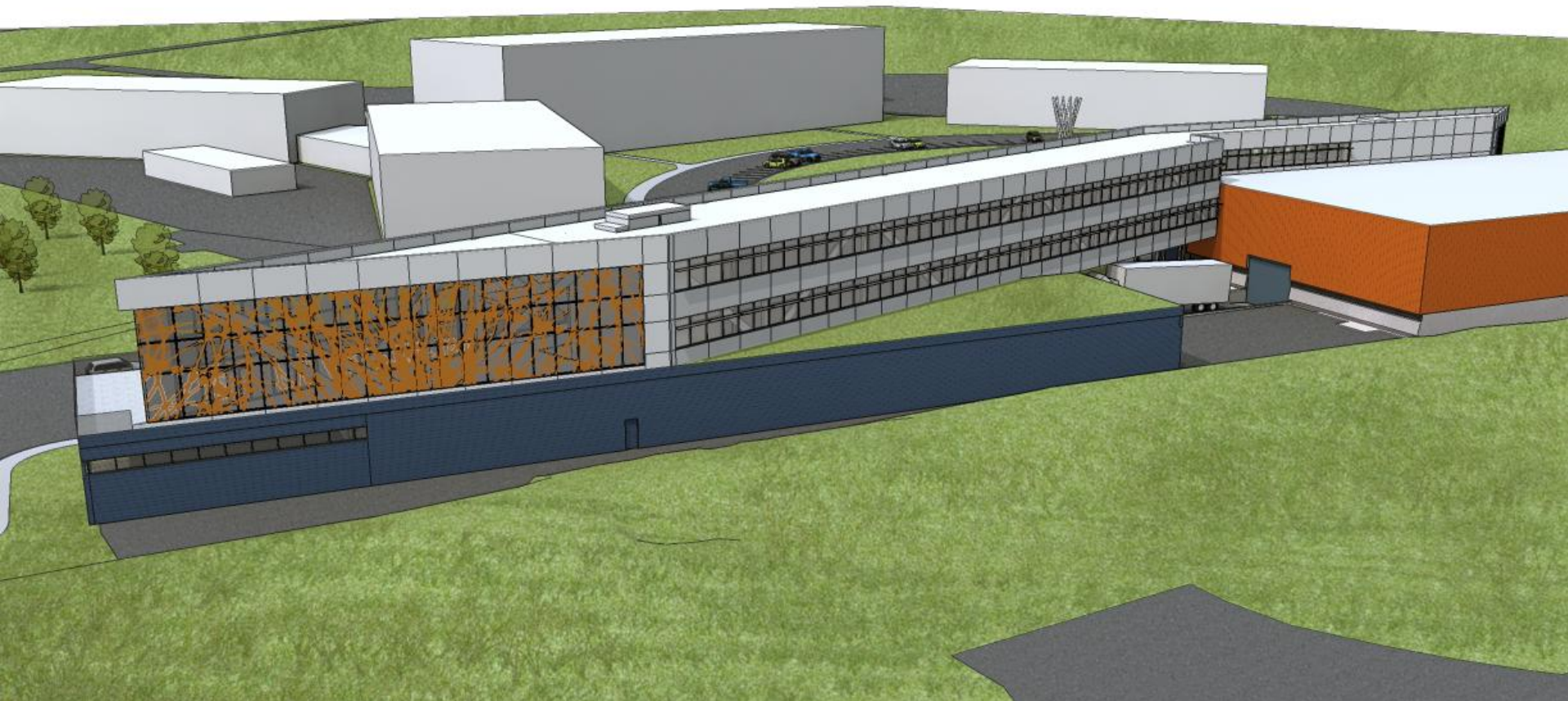
IARC

view from northeast



IARC

view from southwest



IARC drive by

